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On the Drivers of Fiscal Consolidation Attempts – A Bayesian Approach

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"The budget should be balanced, the Treasury should be refilled, public debt should be reduced, the arrogance of officialdom should be tempered and controlled, and the assistance to foreign lands should be curtailed, lest Rome become bankrupt. People must again learn to work, instead of living on public assistance."

Marcus Tullius Cicero[1]

[1] Marcus Tullius Cicero was an orator, statesman, political theorist, lawyer and philosopher of Ancient Rome. He lived from about 106 BC to 43 BC. It is uncertain if he can actually be credited with this quote, or whether the quote was attributed to him in later writings. Nevertheless, it nicely describes the state of the Roman Empire at the time Marcus Tullius Cicero lived and the quote also seems to be a suitable summery of the very high government indebtedness of the present time.

ABSTRACT

In this paper we investigate which factors determine successful fiscal consolidation attempts. The literature on fiscal consolidation suggests a variety of fiscal, macroeconomic and political factors that are likely to influence the success rate of fiscal adjustment attempts. We focus on 31 of these aspects, as independent variables, and analyse their influence on a binary dependent success variable in a Bayesian model averaging framework for generalised linear models. The applied dataset includes 18 OECD countries and comprises the time period from 1975 to 2009. Bayesian model averaging estimates the generalised linear models with the highest posterior probabilities. By applying this method we can test for model uncertainty. As the posterior probabilities for the best models are, however, quite low we emphasise the posterior probabilities of the individual variables being included in the model. We find that the three variables that control for government social spending, the monetary stance and the formation of the government are highly likely to be included in the best model. Accordingly, a decrease in government social spending, an expansionary monetary policy and a unified government are supportive of successful budget consolidation. These results are mostly in line with findings in the previous research. Finally, several robustness checks confirm that the three variables have a high explanatory power for the dependent success variable.

Keywords: *Fiscal Budget Deficit, Public Debt, Fiscal Consolidation, Model Uncertainty, Taxation, Public Expenditure, Bayesian Model Averaging (BMA), Generalised Linear Models*

JEL Classification: B22, B30, C11, C23, E12, E13, E62, H12, H62, H63

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1 Introduction

This paper is an empirical analysis of the drivers of successful fiscal budget consolidation attempts. As a starting point, it is assumed that the model which best describes successful fiscal budget consolidation attempts is unknown. Therefore, the methodology of Bayesian model averaging is applied on a vast set of independent variables, which could possibly be part of a model that describes successful budget adjustment attempts. The results will show, for each variable, a posterior probability indicating the likelihood of the variable being in the model. In addition, the outcome provides posterior model probabilities for each model, in order to find the model which is most likely to be the correct one to describe successful budget consolidation attempts (Hoeting, Madigan, Raftery, & Volinsky, 1999).

The relevance of this paper comes from two sources. First, due to the recent financial crises and the following global economic recession, most OECD countries face severe fiscal consolidation requirements (OECD, 2010). The government primary balance for the OECD area as a whole has worsened from pre crises levels of 0.4% of GDP in 2007 to -6.0% of GDP in 2010. In the same time period, the general government gross financial liabilities of the OECD countries has deteriorated from, 73.1% of GDP to 97.6% of GDP (OECD, 2011). Therefore, fiscal budget consolidation will be a major issue for many countries in the coming years. Second, a large body of research has already been conducted into which factors might influence the success of budget adjustment attempts (for a good overview see Alesina, 2010). Some of these factors will be discussed later in the literature review. As we will see, however, these past analyses have only been carried out for several factors at a time and, therefore, it is assumed that the correct model is known beforehand, or in some cases only single variables are considered. Therefore, when applying Bayesian model averaging to a large number of relevant variables in order to find the model which is most likely the correct one, new insights on success factors for budget consolidation can be gained.

The urgency to control public debt is not a new phenomenon. Extreme examples of the past century are the periods after the first and second world wars. After the First World War, in some countries like France, Germany and Austria, debt was wiped out partly, or completely, by inflation, or even hyperinflation. In other cases, as for example in England and in the US, debt was not reduced as much after the war, but increased dramatically during the Great Depression. After the Second World War, debt consolidation was less painful. The pronounced economic recovery helped many countries to grow out of their debts relatively smoothly (Alesina, 1988). These two options are, however, not feasible for solving the current problem of public indebtedness. First, the negative impacts of high inflation on the economy are enormous and extremely painful, which makes it hard to justify an expansionary monetary policy. Second, there is no extended period of high growth likely in the short-run. Hence, fiscal tightening might be necessary to bring down budget deficits and to stop public debt from growing further. Much evidence on fiscal adjustments can be drawn from the past three decades. Table 1 shows that there were several episodes in which governments could successfully reduce relative debt levels. Two cases in which governments achieved a significant reduction in public debt are often discussed in the literature. These are the cases of Denmark in the mid-1980s and the Irish adjustment in the late 1980s (see, for example, Alesina & Perotti, 1997). In both examples, fiscal correction was based on spending cuts rather than revenue increase. Furthermore, Table 1 indicates the massive increases in public debt in many OECD countries due to the latest financial crises and the economic slowdown. Analysing success factors for fiscal budget consolidations from the past, as done for this paper will, therefore, provide useful information to governments and international organisations on how public debt can be consolidated with as little negative impacts on the economy as possible.

Table 1: General government gross financial liabilities as percentage of GDP

Country	1980	1985	1990	1995	2000	2005	2010
Australia	n.a	n.a	21.5	41.3	24.7	16.1	25.3
Austria	35.8	48.8	57.3	69.8	71.1	70.9	78.6
Belgium	74.5	115.3	125.8	135.4	113.7	95.9	100.7
Canada	45.6	66.9	75.2	101.6	82.1	71.6	84.2
Denmark	43.7	74.7	66.4	81.7	60.4	45.9	55.5
Finland	13.7	18.5	16.4	65.3	52.5	48.4	57.4
France	29.7	37.1	38.6	62.7	65.6	75.7	94.1
Germany	n.a	n.a	n.a	55.7	60.4	71.2	87.0
Greece	n.a	n.a	n.a	101.1	115.3	121.2	147.3
Ireland[a]	65.2	93.8	93.5	82.0	37.8	27.2	94.9
Italy	86.8	88.9	97.6	122.5	121.6	119.9	126.8
Japan	47.1	69.4	63.9	86.2	135.4	175.3	199.7
Netherlands	58.9	87.8	87.5	89.6	63.9	61.1	71.4
Norway	39.7	32.6	29.4	40.9	34.2	49.1	49.5
Portugal	n.a	n.a	n.a	66.8	59.7	71.8	103.1
Spain	27.3	49.5	47.7	69.3	66.5	50.7	62.4
Sweden	46.9	70.4	46.3	81.1	64.3	59.9	49.1
Switzerland	n.a	n.a	31.1	47.7	52.4	56.4	40.2
United Kingdom	48.7	49.2	32.3	51.6	45.1	46.4	82.4
United States	41.9	55.4	63.1	70.7	54.5	61.4	93.6

Source: OEDC (2011)
[a]data for Ireland are from IMF (2011)[2]

In addition to finding single, or selected, groups of success variables for fiscal consolidation, this paper will contribute to the existing literature by attempting to determine the combination of variables that is most likely the best for describing what makes budget consolidation attempts successful, or unsuccessful. When data is modelled in a regression, or in a generalised linear regression, uncertainty about the correct model can be large. Even if a model seems to describe the main research question reasonably well, there are often many modelling choices that might not seem to be as important to the main research question. They can, however, still have a major impact on the findings (Raftery, Painter & Volinsky, 2005). In the existing literature on fiscal adjustments different fiscal, macroeconomic and political variables are mostly analysed in isolation. Alesina, Perotti and Tavares (1998) for instance, analysed the

[2] Data from IMF was taken for Ireland because the OECD only collected data for Ireland beginning from 1998. There might be slight differences between IMF and OECD data because the IMF measures the general government gross debt as percentage of GDP an the OCED measures the General government gross financial liabilities as percentage of GDP.

influence of fiscal adjustment on the macro economy, and the political consequences of fiscal adjustments, separately. Therefore, solving for the most likely model, by applying Bayesian model averaging on a dataset which includes fiscal, macroeconomic and political variables, will provide further insights in the topic of fiscal budget consolidation.

The structure of the paper is as follows. The remainder of Section 1 contains some important definitions. Section 2 reviews the relevant literature on budget consolidation with the focus on finding variables that need to be included in the dataset. In Section 3 the data is described and the methodology for the data evaluation is explained. Section 4 discusses the empirical findings of the research. In Section 5 the robustness checks are reported. Finally, Section 6 summarises and concludes the paper.

1.1 Definitions

Before looking more closely at what the literature states about fiscal consolidation, some definitions are introduced. The definitions are inserted at this stage of the paper because the defined terms are used differently across the research, as discussed in Section 2. Definitions might, therefore, help in the discussion. These definitions will be even more relevant for the data analysis process, which follows in Section 3.

1.1.1 Cyclically adjusted primary deficit

The fiscal budget is influenced by both discretionary policy actions and other *automatic* factors resulting from changes in the macroeconomic environment; predominantly from the change in output (Fedelino, Ivanova & Horton, 2009). Such automatic factors can influence the fiscal budget on both the revenue side and the expenditure side. For example, an expansion in output will increase tax revenues, whereas a decline in GDP will cause lower tax revenues; on the expenditure side, governmental unemployment benefit payments will be smaller in times of an economic boom and higher in a recession. Furthermore, interest payments do not reflect discretionary policy actions and, thus, also incorporate an automatic character that is beyond the influence of the current government. Consequently, when looking at the fiscal balance without considering these automatic factors, government discretionary policy actions might give the impression of being contractionary, or expansionary, although the changes are caused by cyclical movements. In this paper we are interested in the changes in fiscal policy resulting from the intentional actions of policy-makers. Therefore, cyclically-adjusted fiscal variables will be applied when analysing a government's budget consolidation efforts and the success-rate of these consolidation attempts.

To adjust the fiscal budget for interest flows is a relatively easy process. The definition of the primary balance used in this research is simply the current fiscal budget excluding interest payments and interest receivables. The correction for cyclical influences on the primary budget is more complex (Alesina & Ardagna, 1998). There are different ways to adjust for cyclicality, which yields ambiguous results. Two techniques found in the literature are the method of cyclical correction, as suggested by Blanchard (1993)[3] in an OECD publication, and the method which is currently used by the OECD. Blanchard's approach corrects different factors of the fiscal budget for year-to-year changes in the unemployment rate. The OECD methodology, on the other hand, differentiates between the revenues and expenditures of the fiscal budget. On the revenue side, business cycle impacts are calculated with respect to deviations of actual output to potential output. On the expenditure side, unemployment-related transfers are corrected for deviations between actual and structural unemployment (Girouard & André, 2005). In the empirical part of this paper, OECD data are used. These data are corrected for cyclicality by applying the OECD methodology. The detailed formulas for the construction of the cyclically-adjusted budget balance are attached in Appendix A.

1.1.2 Attempts at, and success of, fiscal consolidation

In the discussion concerning fiscal consolidation the use of several key expressions is vague. Hence, in this subsection, definitions for three important terms concerning fiscal consolidation are given. First, the term *budget consolidation* is specified. Second, there is no general rule as to how much the fiscal budget has to improve in order to be counted as a budget consolidation attempt. Therefore, this needs to be defined. Finally, the discussion of when a budget adjustment attempt is successful is highly arbitrary. Therefore, a quantitative definition will be provided.

[3] This procedure was applied in the early studies of Alberto Alesina and Roberto Perotti. See, for example: Alesina and Ardagna (1998), Alesina and Perotti (1995, 1997), and Alesina, Perotti and Tavares (1998). In later papers they used the OECD methodology combined with their own calculations for trend GDP. See, for example: Alesina, Ardagna, Perotti and Schiantarelli (2002).

Price (2010, p. 5) defined fiscal consolidation as follows:

Definition 1

"*At its broadest, and most normative, fiscal consolidation may be defined as a political process aimed at achieving a sustainable fiscal balance, where sustainability means the issuing of debt to finance government expenditure only to the extent that it creates a future debt burden that does not interfere with the attainment of macro-economic objectives: excessive government borrowing can be inflationary, economically destabilising, allocationally distorting and generationally arbitrary in its impact. At its narrowest it means running a budget balance which stabilises government deficits and debt at some pre-specified levels.*"

This definition emphasizes two important aspects. First, fiscal consolidation is defined as a political process. Consequently, whether or not a government attempts to consolidate its fiscal balance is largely politically motivated and, as a result, the success of fiscal consolidation attempts may be influenced by political variables. Second, the aim of fiscal consolidation is to achieve a sustainable fiscal balance. The term sustainable is, however, not defined unambiguously. The broad definition by Price (2010) implies that the sustainable debt level might be different for each country, depending on several macroeconomic factors. Alternatively, the narrow definition of sustainable levels for the fiscal balance tries to quantify the term more specifically. The members of the European Union, for example, imposed in the Maastrich Treaty a 3% ceiling for the deficit to GDP ratio and a 60% ceiling for the debt to GDP ratio (European Union, 1992). The intention of this definition is to assure that the debt to GDP ratio trends to 60% of GDP, a debt level which the European Union believes is sustainable.

In the existing literature fiscal consolidation episodes are usually defined by a certain improvement in the cyclically-adjusted primary balance over a specified time period, or the positive difference between the cyclically-adjusted primary balance and the unadjusted primary balance of the year before over a specified time, as measured by the Blanchard Fiscal Impuls (Blanchard, 1990) [4]. The main difference between the

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[4] The former definition was, for example, used in research by Ahrend, Catte and Price (2006), Guichard, Kennedy, Wurzel and Andre (2007), Alesina and Perotti (1997) and Alesina and Ardagna (1998). An example of the latter definition can be found in Arin, Chmelarova, Feess and Wohlschlegel (2011).

definitions is the amount a fiscal balance has to improve by in order to be considered a consolidation attempt. In the empirical part of this paper we apply the following definition by Alesin and Perotti (1997, p.220) for fiscal consolidation attempts:

Definition 2

"*A period of tight fiscal policy is a year in which the cyclically-adjusted primary deficit falls by more than 1.5 percent of GDP or a period of two consecutive years in which the cyclically-adjusted primary deficit falls by at least 1.25 percentage points a year in both years.*"

This definition considers a sharp yearly improvement of the fiscal budget, as well as a slightly weaker, but still reasonably high, reduction of the budget deficit over at least two years. By applying this specification, only serious budget improvements, which need some effort by the incumbent government, are taken into account as consolidation attempts. In order to perform robustness checks, a stricter rule, as defined in Alesina and Ardagna (1998), is applied in Section 5. According to this definition the cyclically-adjusted primary deficit has to fall by 2% of GDP in one year, or at least 1.5% a year in two consecutive years, to be counted as a consolidation attempt.

Finally, a definition for success is needed. In this, this paper again follows the definition by Alesina and Perotti (1997, p.221):

Definition 3

"*A period of tight fiscal policy is successful if (1) in the three years after the tight period, the ratio of the cyclically-adjusted primary deficit to GDP is on average at least 2% of GDP below its value in the year of tight policy, or (2) three years after the tight period, the ratio of the debt to GDP is 5% of GDP below its level in the year of the tight period.*"

This definition considers a flow variable, accounted for by the improvement of the cyclically-adjusted primary deficit, as well as a stock variable, such as the debt to GDP ratio. Both variables assure that only large and lasting consolidation attempts are considered as successful. This implies that successful consolidations should tend towards sustainable debt levels. The definition was used in several other research papers and has been shown to allow for valid results when analysing the success rate of budget consolidation attempts.5

[5] See, for example: Alesina and Perotti (1997), Alesina and Ardagna (1998), or Arin, Chmelarova, Feess and Wohlschlegel (2011).

2 What the literature says about fiscal consolidation and its success factors

The objective of this literature review is to determine policy variables that might have an influence on the success rate of fiscal consolidation attempts. The analysis of previous research will help to find relevant variables, which should be included in the dataset for the empirical analysis following in Sections 3 to 5. Since the dataset for the empirical part should include as many relevant policy variables as possible, not only research which directly analyses the relation between fiscal consolidation and the success of the adjustment attempts is examined, but other relations - such as the impact of fiscal consolidation on the economy, or the political consequences of fiscal adjustments - are also discussed.

The chapter is organised into three parts. First, direct adjustments of the fiscal budget, such as revenue increases or expenditure cuts, are examined. Then, the interaction between macroeconomics and fiscal consolidation is discussed. Finally, a review of the findings concerning the politics of fiscal adjustment is undertaken. The division of the existing literature into these three categories is done with a focus on the composition of the whole dataset, which is broken down in fiscal, macroeconomic and political variables. As the three categories are connected with each other, the following subsections will, however, be closely interwoven at some stages of the discussion.

2.1 Direct adjustments of the fiscal budget

2.1.1 Components of the fiscal budget

Before analysing which elements of the fiscal budget should be adjusted for a successful consolidation, a brief general overview of the components of the fiscal budget is given. The fiscal budget consists of a revenue side and an expenditure side. In the OECD economic outlook database the fiscal budget is roughly disaggregated in subcategories (OECD, 2011). According to the aggregation levels of the OECD, government income is composed of taxes, social security contributions received by the government and gross government interest receipts. Taxes are split further into direct taxes for both households and businesses and indirect taxes on production and imports (taxes on goods and services). The disbursements account consists of government consumption, transfers received by households, subsidies, investments (gross government fixed capital formation) and gross government interest payments. Government consumption is further broken down into government wage consumption and government non-wage consumption. As consistent panel data, which includes a wide range of countries and a reasonable time period, is only available on these aggregation levels, almost all research regarding budget consolidation is done on the aforementioned categories. Alesina and Perotti (1997), for example, mentioned that the government account should be disaggregated even more in order to gain further insights into the relation between the composition of the fiscal budget and macroeconomic effects. For instance, they pointed out that the variable *transfers* still includes sub variables, such as social security transfers, unemployment compensation and other social assistance programmes, which might be important in determining the success, or failure, of fiscal adjustments. Unfortunately, however, consistent panel data on such a disaggregated level are not yet available.

Figure 1: The fiscal budget

Revenue	Expenditure
Taxes: Direct taxes on households Direct taxes on business Taxes on production and imports	Government consumption: Government wage consumption Government non-wage consumption
Social security contributions received by general government	Transfers received by households
Gross government interest receipts	Subsidies
	Investments (gross government fixed capital formation)
	Gross government interest payments

Source: (OECD, 2011)

2.1.2 Success factors for fiscal budget adjustments

Concerning the question of whether tax increases, or spending cuts, are more successful in budget consolidation processes the empirical research provides a clear answer. For example, Alesina and Perotti (1997) and Alesina and Ardagna (1998) both analysed the issue on the basis of a sample of OECD countries. These two studies applied the definitions for fiscal consolidation attempts and consolidation success discussed in Section 1 of this paper. The conclusion of their empirical research was that fiscal consolidation relying on tax increases is typically short-lived, whereas cuts in public spending are long lasting. These results were confirmed in the most recent research by Alesina and Ardagna (2010). Other research carried out by the OECD also suggested that substantial consolidation depends on cutting current expenditure rather than on increasing taxes (Ahrend, Catte & Price, 2006; Guichard, Kennedy, Wurzel & Andre, 2007). In addition, Guichard et al. (2007) found that the size of the initial budget deficit motivates governments to consolidate. That is, the higher the initial budget deficit, the higher the probability that consolidation is initiated.

To find a possible answer as to why spending cuts are more successful in consolidating a fiscal budget than are revenue increases, the composition of the spending side is of importance. The literature provides unambiguous results on which government cutbacks are more promising. Alesina and Perotti (1996), for example, identified that cuts in government wages and transfer payments are more likely to promote long-lasting consolidations. An analysis of EMU countries by von Hagen, Hughes and Strauch (2001) found that when governments tackle politically sensitive items, such as transfers, subsidies and government wages, the likelihood of a sustained consolidation increases.[6] The explanations for this are largely connected to macroeconomic and political factors. A broader discussion about these factors will follow in the next subsections, but two possible explanations are mentioned here. First, expenditure cuts in these areas, especially reducing the public wage bill, can have a positive effect on overall economic activity by providing freed resources to the private sector (Price, 2010). Second, public downsizing could lead to a more efficient public sector and, thus, make expenditure cuts more sustainable than tax increases. Research which supports this hypothesis was carried out focusing on the healthcare and education sectors (Sutherland & Price, 2007; Joumard, André, Nicq & Chantal, 2008).

To summarise, the existing literature suggests that, for a successful long-lasting fiscal consolidation, it does matter which parts of the fiscal budget are improved. Accordingly, in our data set, which is the basis for the investigation of success factors of fiscal consolidation attempts, disaggregated fiscal policy variables should be used. Due to data availability, as already mentioned above, the OECD aggregation level, which is specified in Figure 1, was applied for the data selection.

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[6] Similar results were also found by Alesina and Perotti (1995), Alesina and Ardagna (1998), Alesina et al. (1998), Guichard et al. (2007) and Alesina and Ardagna (2010).

2.2 Macroeconomic effects and fiscal consolidation

2.2.1 Expansionary fiscal consolidations

Following the Keynesian school, fiscal consolidation would imply a slowdown in economic activities due to less government and private consumption (Mankiw, 2007). Research covering the last three decades indicates, however, that fiscal consolidation does not necessarily cause a decrease in output. Giavazzi and Pagano (1990) were the first who demonstrated, by analysing the cases of Denmark and Ireland, that fiscal deficit reduction can stimulate economic growth if the improvement of the deficit is large in size, decisive and on the expenditure side. A similar result was found by Alesina and Perotti (1997). The dataset of their study encompassed a full sample of OECD countries. They found that, on the one hand, fiscal consolidations based on expenditure cuts in transfers and government wages are more likely to be successful as well as expansionary and, on the other hand, fiscal adjustments focused on tax increases and public investment tend not to persist and are contractionary. In addition to these two articles, several other research reports studied the determinants of large fiscal adjustment and the impact on the economy.[7] All of these studies found that a tight fiscal budget can be expansionary. How is this possible? According to economic theory (examples are discussed in the following two paragraphs), an expansionary fiscal consolidation can be caused by both the demand side and the supply side.

On the demand side there are two explanations for expansionary fiscal consolidations found in the literature. One theory refers to wealth effects and expectations and the other considers credibility effects. The former argues that if a reduction in government consumption is perceived as permanent, a positive wealth effect is created. The reasoning is that the implied reduction in future tax liabilities increases the total wealth of the private sector by decreasing the present-discounted value of taxation. Consequently, a higher level of private wealth increases private consumption (Blanchard, 1990). Additionally, Alesina et al. (1998) argued that the wealth effect is more pronounced the higher the amount of initial public debt prior to a consolidation

[7] To mention only a few examples: McDermott and Wescott (1996); Alesina and Ardagna (1998); Perotti (1999); von Hagen and Strauch (2001); von Hagen, Hughes and Strauch (2002); Ardagna (2004); and Alesina and Ardagna (2010).

attempt. This is because the private sector expects considerably smaller taxes in the future. The credibility effect works through the interest rate, or more precisely, the interest risk premium. The reasoning is that a high budget deficit combined with high public debt increases the default risk for a country and, thus, the risk premium on debt is higher. Starting from a level of a large public deficit and high public debt, a relatively small fiscal adjustment may have significant effects on interest rates. The regained credibility lowers the interest risk premium and, thereby, stimulates interest sensitive private demand, especially investments (Bertola & Drazen, 1993; Sutherland, 1997). Similar to the wealth effect, Alesina, De Broeck, Prati and Tabellini (1992) found evidence that a decrease in the risk premium reduces total deficits by a larger amount, the larger the initial level of debt.

The supply side effects are derived from labour market dynamics and institutions. Two of these effects are mentioned here. First, in a unionised labour market a decrease in government wage consumption lowers the union's bargaining power and, consequently, labour costs decline. The reduced relative unit labour costs lead to an increased profitability for private businesses, which in turn results in higher investments and an expansion in production (Alesina et al., 2002). Second, in the case of a consolidation attempt on the tax side, the neoclassical model produces two ambiguous explanations. On the one hand, an increase in taxes reduces the after tax income of union members, with the lower income leading to a decrease in the aggregated labour supply. On the other hand, there is an opposing effect, because a tax increase reduces wealth and leisure and, thereby, increases the labour supply. According to empirical studies these neoclassical labour supply effects are, however, rather small (Alesina et al., 1998). Therefore, the expansionary supply side effect may mainly work through spending cuts in government wages and the resulting increase in private production.

2.2.2 Other macroeconomic factors accommodating fiscal consolidation

Besides the fact that fiscal consolidation is not necessarily contractionary, the logical reverse causality that economic growth supports fiscal consolidation should also hold. Consequently, macroeconomic variables which are associated with output growth are likely to affect fiscal consolidation attempts positively.

First, interest rates are closely linked to macroeconomic activity. Lower interest rates have an expansionary effect, whereas higher interest rates are more contractionary (Frank & Bernanke, 2009). Thereby, the short-term interest rate is used by the central bank as their monetary policy instrument. Research by Ahrend et al. (2006) found strong econometric evidence that a supporting monetary policy stance at the inception of the fiscal consolidation results in longer lasting and larger consolidation achievements. As central banks are generally independent institutions, the causality might, however, run in the opposite direction. That is, if the government indicates a commitment to seriously reduce public debt, then inflation expectations decrease and, therefore, the central bank will have the scope to ease the monetary stance. What is more, according to the OECD's Global Model, a decrease in short term interest rates can partially offset the contractionary impact of fiscal tightening (Herve, Pain, Richardson, Sedillot & Beffy, 2011). The effect of long term interest rates on fiscal consolidation works mainly through the credibility effect explained in the previous subsection. This concludes that the higher the fiscal imbalance, the higher the long term interest rates.[8] The increased interest rates have an adverse effect on growth, because lower investment implies a slower growth of the capital stock, which in turn results in a slowdown in labour productivity growth (Kumar & Woo, 2010). Additionally, Guichard et al. (2007) proved that high interest rates in combination with large deficits are a factor that supports the initiation of fiscal adjustments and also leads to overall larger and longer lasting consolidations.

Other macroeconomic variables which have an influence on fiscal consolidation are the rates of inflation, exchange rates that are linked to external trade activity and unemployment rates. Guichard et al. (2007) concluded that macroeconomic pressure, which includes high inflation, currency depreciation and the fact of being at the bottom of the macroeconomic cycle, increases public awareness of problems in public finance and, therefore, resistance against budget consolidation weakens. In an investigation of inflation on budget adjustments, Hamann and Prati (2002) also found that the higher the rate of inflation before the stabilisation, the higher the chance that the stabilisation will

[8] There is a fairly large body of empirical literature that observes the impact of public deficits and debt on long-term government bond yields. See, for example, Ardagna, Caselli and Lane (2004), or Baldacci and Kumar (2010).

succeed. These findings are compliant with the *crisis hypothesis*, which will be introduced in the next subsection. In addition, a weak currency is also likely to accommodate fiscal consolidation, because a depreciation of the home currency tends to increase external demand for domestic products and, hence, some of the reduction in domestic government demand caused by the fiscal cutback can be compensated for (OECD, 2010). Finally, a variable which is directly linked to fiscal expenditure (through transfer payments) and strongly correlates with the economic cycle is the unemployment rate. Thus, a higher unemployment rate makes fiscal consolidation more difficult.

To summarise this subsection, the empirical evidence indicates that fiscal consolidation can be expansionary, especially if the adjustments are on the spending side and are large, credible and decisive. Furthermore, the reverse argument that a growth in output is likely to support consolidation efforts also holds. Therefore, various variables associated with macroeconomic activity should be included in the data set. Concerning interest rates, the change in short-term interest rates; which reflects monetary policy activity; and long-term government bond rates are both considered. The real GDP growth rate, inflation rates and unemployment rates are other important macroeconomic indicators which have to be included in the dataset. To accommodate international connectivity, changes in the effective exchange rate and net exports are also taken into account. Also of importance are unit labour costs, which are associated with the supply side effect. Furthermore, because the initial size of the public debt and the size of the deficit reduction might be relevant for a expansionary budget consolidation, these two fiscal variables have to be added to the dataset as well.

2.3 Politics and fiscal adjustment

The definition by Price (2010), introduced in Subsection 1.1.2, states that fiscal consolidation is a political process. This implies that there must be different political aspects that motivate fiscal adjustment and have an impact on the success of fiscal consolidations. First, a review on the political consequences of fiscal adjustments for incumbent governments is given. Then, other explanations as to why fiscal consolidation might be delayed, and not successful in stabilising public debt, are outlined. Finally, the importance of fiscal rules and independent institutions is explained.

2.3.1 Political consequences of fiscal adjustments

One reason why fiscal consolidation might be postponed, or insufficiently carried out, is that the incumbent government fears to lose popularity and, as a consequence, will be replaced in the next election. These beliefs are clearly contradicted by Alesina et al. (1998). The authors found, by applying descriptive statistical methods and regression analysis on a sample of 19 OECD countries that governments which significantly and systematically reduce their budget deficits do not lose either in popularity, or in the next election. Furthermore, there is evidence that spending cuts have a more positive impact on government popularity than do tax increases. [9] These evidences might be closely linked to the findings presented in the previous subsection, that consolidations based on spending cuts are more likely expansionary and consequently less costly in terms of output. In current research carried out by Alesina, Carloni and Lecce (2010) the authors also tested for the reverse causality, namely that only *strong and popular* governments tackle fiscal budget deficits and, because of their strong position, they are not voted out of office. No convincing evidence has been found that only strong governments can implement budget consolidation without being penalised at the polls. What happens, however, if governments follow an expansionary fiscal policy? Research by Brender and Drazen (2005, 2007) indicated that, in established democracies, governments which try to opportunistically manipulate fiscal policy prior to elections are punished by voters, rather than being rewarded. This leads to the conclusion that, according to statistical evidence, neither a restrictive fiscal policy implies a loss in popularity for the incumbent government, nor is a loose fiscal budget honoured by voters.

2.3.2 Why are adjustments delayed?

If there are no negative political consequences for perusing decisive and large budget consolidations, and if fiscal adjustments do not cause losses in output, the question arises: Why is it so difficult to reduce public debt? There are two answers found in the literature, which are both related to political influence and the share of power.

First, if fiscal consolidation occurs, the country as a whole will profit, but there can be certain groups which have to pay a higher share of the cost and, because they are

[9] For research which comes to the same conclusion by applying more recent data see, for instance, Alesina and Ardagna (2010)

especially influential, they can impede adjustments. Which groups may be more vocal differs from country to country. In some countries, if an adjustment is done through wage cuts in the public sector, government employees may decide to strike. This can lead to serious disruptions. Another group with major influence may be pensioners, who are well organised and have a lot of free time in order to persuade politicians not to reduce their retirement benefits. Furthermore, lobbyists of certain, government favoured sectors are willing to invest a lot of money in campaigning for their interests (Alesina, 2010). In a recent study, Arin et al. (2011) provided support for this last argument. They found evidence that corrupt governments are less likely to succeed when trying to consolidate their fiscal budget; mainly because corrupt governments try to keep the expenditure side large in order to serve the interests of important lobbyist groups (Arin et al., 2011). Finally, on the revenue side, tax payers try to influence the taxation structure to their advantage, while tax evaders try to cripple the collection system (Alesina, 2010).

Second, Alesina and Drazen (1991) modelled the problem of delayed adjustments through a political game known as a *war of attrition*. The model assumes that there are political conflicts over how to share the costs of spending cuts, or tax increases, in a country. As there are multiple opposing interests, the situation leads to a stalemate. Not to consolidate the budget immediately may be costly, but all parties hope that the others have to bear the costs and the *war* continues until one side gives in. Thus, fiscal consolidation is more difficult the larger the fractionalisation of a society and the higher the political polarisation.[10] The authors also conclude that the model is consistent with the *crisis hypotheses*, which states that a sharp and painful deterioration of the economy is necessary to trigger a consolidation.[11] In this case it may be just too expensive to postpone a consolidation and not find a political consensus. Similarly, by applying the war of attrition model, Alesina, Ardagna and Trebbi (2006), attempt to determine the

[10] For similar results see, for example, Alesina and Drazen (1991), Tavares (2004), or Mierau, Jong-A-Pin and de Haan (2007), which all found that too many parties will hamper political decisions.

[11] For a sound paper in which the authors try to prove the hypothesis that economic crises induce successful consolidation attempts see Drazen and Easterly (2001). They ranked countries from best to worst by considering certain variables, such as inflation and budget deficits, and tested whether the lowest ranked countries move up in the ranking when they stabilise their budgets. Indeed, they found evidence that the worse a country’s ranking before stabilisation, the higher its ranking afterwards.

optimal conditions for fiscal adjustments. They also found support for the crisis hypothesis and, on the basis of that, they observed under which political conditions a crisis leads to a successful budget consolidation. Their main conclusion was that budget stabilisation is more likely if a *strong* government is in office when a crisis occurs. Strong is used in this sense to indicate that the government can withstand political opposition and act in a decisive manner. Consequently, a presidential system or a system in which the executive faces fewer institutional veto threats, are favourable conditions for successful budget adjustments. Moreover, the governing party should hold the executive and the legislature at the same time and the ruling party should hold a large majority. Concerning the timing, they found that, in addition, successful consolidation is more likely to occur directly after an election, when governments enjoy the trust of the voters and when new elections are a long time in the future. Besides this, Tavares (2004) found that left-leaning governments are more successful in adjusting the fiscal budget through spending cuts and budget consolidations, whereas right-leaning governments are more effective when applying tax increases. The rationale for this is that the governments' consolidation attempts become more credible if they signal commitment by undertaking consolidation efforts in areas that are not in line with their own parties' credo.

2.3.3 Fiscal rules and institutions

From the previous paragraph, it is obvious that implementing fiscal consolidation is a politically difficult process. Therefore, fiscal rules which impose more fiscal discipline on governments in office have been introduced and independent institutions which are less likely affected by distort incentives could support fiscal consolidation in the future. In the next two paragraphs we examine the question of which of the fiscal rules promise more success for fiscal consolidation. A review on the independence of fiscal institutions is also undertaken.

The number of countries which have adapted fiscal rules has increased continuously over the last fifteen years, especially in the European Union (EU) where the Maastrich Treaty became effective in 1993 (Ayuso-i-Casalas, Hernandez, Moulin & Turrini, 2007). According to Ayuso-i-Casalas et al. (2007), the fiscal rules most frequently used in the EU are budget balance and debt rules. At the central government level, expenditure rules have also been introduced by about a quarter of EU countries. In contrast, revenue rules, which are usually intended to limit the tax burden as a percentage of GDP, are almost non-existent, or only infrequently used. A difficulty that appears when comparing different rules and their contribution to success is the heterogeneity of rules across countries. Nevertheless, Guichard et al. (2007) found a statistically significant positive relation between fiscal rules with an embedded expenditure target and the success rate of fiscal adjustments. An important advantage of expenditure rules is that spending authorities can be held accountable for their budgets (Atkinson & van den Noord, 2001). Furthermore, a restricted growth rate on expenditures may help to prevent an upward-drift of the fiscal budget during an economic upswing, which supports budget consolidation in good times (Anderson & Minarik, 2006). Also of high importance is that budget transparency is ensured and that an effective enforcement mechanism is in place (Debrun & Kumar, 2007). The paramount importance of an enforcement mechanism has also been highlighted by Ayuso-i-Casala et al. (2007) and Alesina (2010).

Analogous to the independence of monetary policy authorities there is the question of whether delegating some parts of fiscal activity to independent agencies could enhance the efficiency and effectiveness of fiscal policy.[12] The main problem is that a large part of fiscal policy concerns redistribution of funds, as politicians prefer not to delegate redistributive policies (Alesina & Tabellini, 2007). The reason for this is that discretion over redistribution is important for politicians in winning the votes of their targeted groups (Alesina & Tabellini, 2008). Nevertheless, independent institutions might be especially valuable in respect to pro-cyclical budget consolidation (Price, 2010). This is because in the case of budget surpluses in a cyclical upswing the pressure on politicians to increase spending, or reduce taxes, is high. In this situation an independent institution might provide the government with arguments to justify unpopular decisions. An independent fiscal council could also be of great value for budget consolidation through providing independent short-term and long-term economic and fiscal forecasts in order to prevent governments from applying overoptimistic projections in the budget process (Debrun, Hauner & Kumar, 2009). To date few countries have set up an independent council, but interest in such agencies is growing. For instance, in Sweden the Swedish Fiscal Policy Council was established in 2007 (Swedish Fiscal Policy Council, 2011),

[12] Blinder (1997) discussed the social optimality of delegating certain parts of fiscal policy.

while the United Kingdom (UK) decided in 2010 to establish an independent fiscal agency (Office for Budget Responsibility, 2011). The European Central Bank proposed an independent fiscal council for the EU last year (ECB, 2010). Due, however, to the importance for politicians to have control over the redistribution of public funds, an independent treasury, with similar independence to a central bank, might hardly find acceptance among politicians (Alesina, 2010).

To conclude this subsection, we would like to match the findings from the literature on politics and fiscal adjustment with our dataset. First, research shows no evidence that large and decisive fiscal consolidation may harm an incumbent government's popularity. Once again the literature suggests that consolidation through spending cuts is more favourable than tax increases for both politicians' popularity and the growth of the economy. As a result, division of the fiscal budget, as suggested in the first part of this section, gains additional support from a political perspective. To control for factors which may delay, or impede, fiscal consolidation we include a corruption variable and a variable that considers the percentage of the total population accounted for by retirees. Furthermore, according to the war of attrition model, the composition of the government may be essential to the success of fiscal consolidation. Therefore, a dummy variable which distinguishes between single-party and coalition governments is included in the dataset. Besides, the political orientation of the government in office may influence the success of fiscal adjustment and, hence, a differentiation between left, centre and right governments is made. Finally, as stated in the last subsection, fiscal rules and independent fiscal agencies might have a significant influence on the success of fiscal consolidation attempts. But as such rules have only been put in place during the past ten to fifteen years, and because independent agencies are only implemented in a very fragmented manner in a few countries, it is unfortunately not possible to integrate these variables into a panel dataset covering a considerable number of countries for the last three decades.

3 Data and Methodology

3.1 Data

3.1.1 Dataset

Initially, the 30 OECD member countries as at 2000 were taken into consideration for the dataset. The focus on these nations is mainly because the OECD has a sophisticated database for fiscal variables. For some countries, however, especially younger OECD members, there are still large gaps in the data series. Therefore, 4 nations (Mexico, the Republic of Korea, Slovakia and Turkey) were excluded a priori. For these countries the data was not sufficient to calculate the dependent success variable even once over the observation period. In addition, for Australia, the Czech Republic, Greece, Hungary, Luxemburg and Portugal crucial data points for the independent variables were missing. As, in Bayesian Model Averaging, data points for all independent variables are needed, these countries are also excluded from the dataset. The remaining 20 nations represented in the dataset are Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, the United Kingdom and the United States.

The time dimension encompasses the period from 1975 to 2009. This time span was chosen because accurate political variables are only available back to 1975 and, for several fiscal and macroeconomic variables, data availability decreases rapidly the further back we go in time. Due to the nature of the definition for successful consolidation attempts, which can only be calculated on the basis of the following three years, the dataset is limited to years until 2006. Furthermore, it is important to mention that the dataset does not consist of proper panel data as the two-dimensionality of the data might indicate. Because for the empirical analysis, only years in which a country made an attempt to consolidate its budget are considered and, because some years drop out due to insufficient data availability, the dataset used as input for Bayesian model averaging is no longer of proper panel format. This issue will be considered further in the next subsection.

3.1.2 Dependent success variable

The dependent variable takes into account each year in which the incumbent government started a consolidation attempt. Consolidation attempts are calculated according to Definition 2, as stated in the Subsection 1.1.2. The calculation of the variable is based on OECD data (OECD, 2011). For ease of understanding Definition 2 is again stated here (Alesina & Perotti, 1997, p.220):

"A period of tight fiscal policy is a year in which the cyclically-adjusted primary deficit falls by more than 1.5 percent of GDP or a period of two consecutive years in which the cyclically-adjusted primary deficit falls by at least 1.25 percentage points a year in both years."

In Table 2 all of the 104 consolidation attempts, for the 24 countries for which consolidation attempts could have been calculated, are listed. As already mentioned in the previous subsection, however, some data points had to be dropped due to insufficient data for the independent variables. The years not considered are highlighted in bold characters. Hence, 6 countries (Australia, the Czech Republic, Greece, Hungary, Luxembourg and Portugal) are removed from the dataset. For Iceland and Finland one observation had to be neglected. Hence, we have a final dataset of 79 observations.

Table 2: Consolidation attempts *loose criterion*

Australia	**1986**	**1987**	**1988**						
Austria	1984	1996	1997	2001	2005				
Belgium	1982	1984	1987	1993	2006				
Canada	1981	1986	1987	1995	1996	1997			
Czech Republic	**2004**								
Denmark	1983	1984	1985	1986	2004	2005			
Finland	**1977**	1981	1984	1988	1994	1996	1998	2000	
France	1996								
Germany	1996								
Greece	**1986**	**1987**	**1991**	**1994**	**1996**	**1998**	**2005**		
Hungary	**1996**	**1999**							
Iceland	**1984**	1995	2004	2005	2006				
Ireland	1983	1984	1987	1988	2000				
Italy	1982	1983	1991	1992	1993	1997			
Japan	1984	1999	2001	2006					
Luxembourg	**1993**	**1994**	**1995**	**1997**					
Netherlands	1983	1991	1993	1996	2004	2005			
New Zealand	1987	1989	2000	2002					
Norway	1994	1995							
Portugal	**1982**	**1983**	**1984**	**1992**	**2002**	**2006**			
Spain	1987	1992	1996						
Sweden	1976	1981	1986	1987	1994	1996	1997	1998	2000
Switzerland	1999								
United Kingdom	1982	1996	1997	1998					

The dependent success variable has the form of a dummy variable. If a consolidation attempt was successful the variable is 1, if a consolidation attempt was not successful the variable is 0. A successful consolidation attempt is defined as per Definition 3 from Subsection 1.1.2. The definition is repeated below (Alesina & Perotti, 1997, p.221):

"A period of tight fiscal policy is successful if (1) in the three years after the tight period, the ratio of the cyclically-adjusted primary deficit to GDP is on average at least 2% of GDP below its value in the year of tight policy, or (2) three years after the tight period, the ratio of the debt to GDP is 5% of GDP below its level in the year of the tight period."

Table 3 summarises all the successful consolidation attempts. All-in-all, out of the 104 consolidation attempts, 40 were successful. Six of these successful consolidation attempts had to be dropped because of insufficient data. These observations are indicated in bold.

Table 3: Successful consolidation attempts *loose criterion*

Belgium	1982	1993				
Canada	1995	1996	1997			
Denmark	1983	1984	1985	1986		
Finland	1996	1998				
Greece	**1991**	**2005**				
Iceland	**1984**	1995	2004			
Ireland	1987	1988	2000			
Italy	1997					
Luxembourg	**1993**	**1994**	**1995**			
Netherlands	1993	1996				
New Zealand	1987	2000	2002			
Norway	1994	1995				
Spain	1996					
Sweden	1986	1987	1994	1996	1997	1998
United Kingdom	1996	1997	1998			

Finally, after filtering out all the attempts with insufficient data we have a dataset of 79 consolidation attempts, out of which 34 were successful. This results in 45 zeros and 34 ones in the dataset.

In order to perform robustness checks, a stricter rule, as defined in Alesina and Ardagna (1998), was applied to calculate the dependent variable. According to this definition the cyclically-adjusted primary deficit has to fall by 2% of GDP in one year, or at least by 1.5% a year in two consecutive years, to be classified as a consolidation attempt. Applying the stricter definition, results in 70 consolidation attempts (see Table 4). For some countries, single observations dropped out. France, Spain and Switzerland ended up with no consolidation attempts at all. After deducting the attempts for which insufficient data is available, 52 observations remain in our dataset.

Table 4: Consolidation attempts *strict criterion*

Australia	**1986**	**1987**	**1988**				
Austria	1984	1996	1997	2001	2005		
Belgium	1982	1984	1993	2006			
Canada	1995	1996	1997				
Czech Republic	**2004**						
Denmark	1983	1984	1985	1986	2004	2005	
Finland	**1977**	1981	1984	1988	1996	1998	2000
France							
Germany	1996						
Greece	**1991**	**1994**	**2005**				
Hungary	**1996**	**1999**					
Iceland	**1984**	1995	2004	2005			
Ireland	1983	1984	1987	1988			
Italy	1982	1992	1993	1997			
Japan	1999	2006					
Luxembourg	**1993**	**1994**	**1997**				
Netherlands	1991	1993	1996				
New Zealand	1987						
Norway	1995						
Portugal	**1982**	**1983**	**1984**	**1992**			
Spain							
Sweden	1976	1981	1986	1987	1996	1997	
Switzerland							
United Kingdom	1982	1997	1998				

The definition for successful consolidation attempts for the *stricter criterion* remains the same as for the *loose criterion*. This results in 31 successful consolidations out of 70 attempts (see Table 5). Five of the observations drop out, as indicated in bold characters, which leaves us with 26 successful consolidation attempts. Consequently, the binary dependent variable, which is used for the robustness check, consists of 26 zeros for the unsuccessful attempts and 26 ones for the successful consolidation attempts.

Table 5: Successful consolidation attempts *strict criterion*

Belgium	1982	1993		
Canada	1995	1996	1997	
Denmark	1983	1984	1985	1986
Finland	1996	1998		
Greece	**1991**	**2005**		
Iceland	**1984**	1995	2004	
Ireland	1987	1988		
Italy	1997			
Luxembourg	**1993**	**1994**		
Netherlands	1993	1996		
New Zealand	1987			
Norway	1995			
Spain				
Sweden	1986	1987	1996	1997
United Kingdom	1997	1998		

As the derivation of the dependent variable was quite complicated, Table 6 provides a summary of the main characteristics of the two dependent variables.

Table 6: Summary dependent variables

Variable	Description	Source
Success variable for consolidation attempts **loose** (improvement of cyclically-adjusted primary deficit by more than 1.5% of GDP in one year, or 1.25% in two consecutive years)	Dummy variable, for which an unsuccessful consolidation attempt is 0 and a successful attempt is 1	Data : OECD Calculation according to: Alesina and Perotti (1997)
Success variable for consolidation attempts **strict** (improvement of cyclically-adjusted primary deficit by more than 2.0% of GDP in one year, or 1.5% in two consecutive years)	Dummy variable, for which an unsuccessful consolidation attempt is 0 and a successful attempt is 1	Data : OECD Calculation according to: Alesina and Ardagna (1998)

3.1.3 Independent variables

By applying Bayesian model averaging, we attempt to find the generalised regression model that has the highest explanatory power for the dependent variable. Therefore, an aim of this research is to build a dataset with as many independent variables as possible. Nonetheless, the main criterion for a variable to be included in the dataset was that there must be evidence of a possible logical relation between the dependent and the independent variable. For this reason a thorough literature review was conducted (see

Section 2). Based on the literature review, a dataset with 33 independent variables was constructed. The variables are divided into 3 categories; fiscal variables, macroeconomic variables, and political variables. In addition to the relevance of a certain variable, data availability was another main criterion in the variable selection process. In order to be able to run a regression with Bayesian model averaging each data point on the left- and the right-hand side of the equation needs to be filled in. Therefore, the dataset is restricted to variables for which sufficient data was accessible.

The dataset employs 15 independent variables, which are related to fiscal policy. As indicated in Table 7 there are 16 variables listed. This is because variable 14 *Change in leading government wage consumption* was used in one of the robustness checks in exchange for variable 13 *Change in government wage consumption*. The BMA calculations were, however, always performed with 15 fiscal variables. The variables can be divided into:

- general government budget variables (1 and 2);
- government revenue related variables (3 - 7, indicated in green);
- government spending related variables (8 – 14, indicated in red);
- one variable for government liabilities (15); and
- one variable for government investment (16).

As we are interested to find an answer as to which policy actions could possibly have had an influence on the success of a budget consolidation attempt, most variables are change variable. For example, Variable 6 *Change in cyclically-adjusted direct taxes on business* tests whether or not an increase, or a decrease, in business tax is likely to support the success of a budget consolidation. The same logic applies to the spending side. Variable 10 *Change in social security benefits paid by general government*, for example, provides an indication of whether or not a decrease, or an increase, in social benefit payments helps to improve a government's budget. Furthermore, variables which might be impacted by the economic cycle were adjusted for influences caused by cyclical movements. The exact methodology for measuring cyclically adjusted budget balances, as used by the OECD, is attached in Appendix A.

Table 7: Independent fiscal variables

	Variable	Abbreviation	Description / Calculation	Source
1	Cyclically-adjusted government primary balance	cy_bal_pr	Cyclically adjusted government primary balance as a percentage of GDP	OECD Database
2	Change in cyclically-adjusted government primary balance	Δcy_bal_pr	(Cyclically-adjusted government primary balance$_{(t)}$ - Cyclically-adjusted government primary balance$_{(t-1)}$) / GDP$_{(t)}$	OECD Database
3	Change in cyclically-adjusted primary receipts	Δcy_rec_ex	(Cyclically-adjusted receipts less gross government interest receipts / GDP)$_{(t)}$ - (Cyclically-adjusted receipts less gross government interest receipts / GDP)$_{(t-1)}$	OECD Database
4	Change in cyclically-adjusted taxes on production and imports	Δcy_tx_prod	(Cyclically-adjusted taxes on production and imports / GDP)$_{(t)}$ -(Cyclically adjusted taxes on production and imports / GDP)$_{(t-1)}$	OECD Database
5	Change in cyclically-adjusted direct taxes on business	Δcy_tx_bus	(Cyclically-adjusted direct taxes on business / GDP)$_{(t)}$ - (Cyclically adjusted direct taxes on business / GDP)$_{(t-1)}$	OECD Database
6	Cyclically-adjusted direct taxes on households	Δcy_tx_hh	(Cyclically-adjusted direct taxes on households / GDP)$_{(t)}$ - (Cyclically adjusted direct taxes on households / GDP)$_{(t-1)}$	OECD Database
7	Change in cyclically-adjusted social security contributions received by general government	Δcy_soc_con	(Cyclically-adjusted social security contributions received by general government / GDP)$_{(t)}$ - (Cyclically-adjusted social security contributions received by general government / GDP)$_{(t-1)}$	OECD Database
8	Change in cyclically-adjusted primary disbursements	Δcy_dis_pr	(Cyclically-adjusted disbursements less gross governement interest payments / GDP)$_{(t)}$ - (Cyclically adjusted disbursements less gross governement interest payments / GDP)$_{(t-1)}$	OECD Database
9	Change in cyclically-adjusted primary disbursements including net capital outlays of the government	Δcy_dis_prca	(Cyclically-adjusted primary disbursements including net capital outlays of the government / GDP)$_{(t)}$ - (Cyclically-adjusted primary disbursements including net capital outlays of the government / GDP)$_{(t-1)}$	OECD Database
10	Change in social security benefits paid by general government	Δgv_soc_ben	(Social security benefits paid by general government / GDP)$_{(t)}$ - (Social security benefits paid by general government / GDP)$_{(t-1)}$	OECD Database
11	Change in subsidies paid by general government	Δgv_subs	(Subsidies paid by general government / GDP)$_{(t)}$ - (Subsidies paid by general government / GDP)$_{(t-1)}$	OECD Database

	Variable	Abbreviation	Description / Calculation	Source
12	Change in government non-wage consumption	Δgv_nwg_con	(Government non-wage consumption / GDP)$_{(t)}$ - (Government non-wage consumption / GDP)$_{(t-1)}$	OECD Database
13	Change in government wage consumption	Δgv_wg_con	(Government wage consumption / GDP)$_{(t)}$ - (Government wage consumption / GDP)$_{(t-1)}$	OECD Database
14	Change in leading government wage consumption	Δgv_wg_con_lead	(Government wage consumption / GDP)$_{(t+1)}$ - (Government wage consumption / GDP)$_{(t)}$	OECD Database
15	General government gross financial liabilities	gv_gr_liab	(General government gross financial liabilities / GDP)$_{(t)}$	OECD Database
16	Change in government fixed capital formation	Δgv_cp_frm	(Government fixed capital formation / GDP)$_{(t)}$ - (Government fixed capital formation / GDP)$_{(t-1)}$	OECD Database

Overall, there are 10 macroeconomic variables included in the dataset (cf. Table 8). These variables are as well derived from the literature review in Section 2. Except for inflation (3) and the real long-term interest rate (5), changes in the macroeconomic variables are considered. This is because inflation and the real interest rate may have an influence on the fiscal budget in absolute terms, whereas, for all the other variables the relative change could support, or threaten, the consolidation efforts of a government.

Table 8: Independent macroeconomic variables

	Variable	Abbreviation	Description / Calculation	Source
1	Change in unemployment rate	Δunempl	(Unemployment rate$_{(t)}$ - Unemployment rate$_{(t-1)}$) / Unemployment rate$_{(t-1)}$	OECD Database
2	Change in real GDP	Δgdp_real	Real GDP$_{(t)}$ - Real GDP$_{(t-1)}$	OECD Database
3	Inflation	inflation	Year on year change in consumer price index	OECD Database
4	Change in short-term interest rate	Δshort_ir	Short-term interest rate$_{(t)}$ - Short-term interest rate$_{(t-1)}$	OECD Database
5	Real long-term interest rate	long_ir_real	Long-term interest rate on 10 year government bonds – inflation	OECD Database
6	Change in net exports	Δnet_exp	(Net exports of goods and services / GDP)$_{(t)}$ - (Net exports of goods and services / GDP)$_{(t-1)}$)	OECD Database
7	Change in nominal effective exchange rate	Δexch_eff	(Nominal effective exchange rate$_{(t)}$ - Nominal effective exchange rate$_{(t-1)}$) / Nominal effective exchange rate$_{(t-1)}$ (A minus sign indicates a devaluation of the currency)	OECD Database
8	Change in private consumption	Δprv_cons	(Private consumption / GDP)$_{(t)}$ - (Private consumption / GDP)$_{(t-1)}$	OECD Database
9	Change in private fixed capital formation (private investments)	Δprv_cp_frm	(Gross fixed capital formation - Gross government fixed capital formation / GDP)$_{(t)}$ - (Gross fixed capital formation - Gross government fixed capital formation / GDP)$_{(t-1)}$	OECD Database
10	Change in unit labour cost in the manufacturing sector	Δunt_lb_cst	(Unit labour cost in the manufacturing sector $_{(t)}$ / Unit labour cost in the manufacturing sector $_{(t-1)}$) - Unit labour cost in the manufacturing sector $_{(t-1)}$	OECD Database

Four of the six political variables are retrieved from the Database of Political Institutions (2010). This database provides a broad variety of political data back to 1975. For the variable *Population over 65*, which serves as a proxy for pensioners, data from the World Bank database (2011) was used.[13] The variable *Corruption Index* is a combination of two indices from the Political Risk Services Group (2011) and the

[13] The sources are included in the list of references: Database of Political Institutions (2010) and The World Bank (2011)

International Transparency Organisation (2011).[14] Furthermore, it is worth mentioning that we use dummy variables to distinguish between left and right governments. Consequently, if both dummy variables are zero a centre government is in power.

Table 9: Independent political variables

	Variable	Abbreviation	Description / Calculation	Source
1	Population over 65	pop_65over	Population over 65 years as percentage of total population	World Development indicators (WDI) Worldbank
2	Herfindahl Index for Governments	herf_gov	The sum of the squared seat shares of all parties in the government (the closer to one, the less fragmented the government)	Database of Political Institutions (DPI 2010)
3	Corruption Index	corruption	Higher number means less corruption (the variable is constructed from two sources: "International Country Risk Guide" and "Transparancy International Corruption Perception Index")	Political Risk Services Group and "ICRG"
5	Formation of the ruling government	gov_form	Dummy variable equal to 1 if a single party cabinet is in power and 0 if coalition cabinet is in power (including ministers from two or more parties)	Database of Political Institutions (DPI 2010)
6	Left-wing government	gov_left	Dummy variable equal to 1 if government (cabinet) is left-wing, otherwise 0	Database of Political Institutions (DPI 2010)
6	Right-wing government	gov_right	Dummy variable equal to 1 if government (cabinet) is right-wing, otherwise 0	Database of Political Institutions (DPI 2010)

3.1.4 Summary statistics

The summary statistics for all of the variables used in the prime BMA evaluations with the *loose definition* for consolidation attempts are presented in Table 10. Overall, there were 79 observations (for details cf. Table 2). In the first row, the summary statistics of the dependent variable are indicated. The last 2 columns, which state the minimum and maximum observations, suggest that it must be a binary variable. As already mentioned

[14] The sources are included in the list of references: The Political Risk Services Group (2011) and Transparency International (2011)

in Subsection 3.1.2, out of the 79 consolidation attempts, 35 were successful and 44 were unsuccessful. Hence, the dataset encompasses 35 ones and 44 zeros for the dependent variable. This explains the mean, which is, at 0.43, slightly below 0.5. The following 33 rows summarise the independent variables. When analysing these data it is important to bear in mind that the data points of the independent variables are related to budget consolidation attempts in general, and not to successful budget consolidation attempts. In other words, the summary statistics state nothing about the relation between the independent variable and the success rate of budget consolidation attempts. Conclusions can only be drawn regarding the relation between consolidation attempts and the independent variables. Nevertheless, the summary statistics already provide us with interesting information. Therefore, it is worthwhile briefly mentioning some observations here.

In the third row of Table 10 we can observe that the minimum value for the change in the cyclically-adjusted government primary balance is 1.28%. This makes sense, because according to Definition 2 the improvement in the cyclically-adjusted primary balance has to be at least 1.25% in order to be counted as a consolidation attempt. Rows 4 to 8 are variables which control for governments' revenue side. The positive means of all these variables indicate that governments tend to increase taxes and other revenue contributing items when initiating a budget consolidation attempt. In contrast, the negative means of variables on governments' expenditure side (rows 9 to 15) indicate governments' tendency to decrease spending when trying to consolidate the budget. In general, the relatively high standard deviations in relation to the mean for most of the change variables are quite interesting. This observation limits us somewhat to drawing clear conclusions from only considering the basic statistics.

Some variables are interesting to analyse in the light of the crisis hypothesis, which states that a sharp and painful deterioration of the economy combined with pressure on the fiscal budget is necessary to trigger a fiscal consolidation (cf. Subsection 2.4.2, or Drazen & Easterly, 2001). It is interesting in this context that, for example, the mean of the cyclically-adjusted government primary balance (row 2) is positive. In other words, on average, the government's primary balances are positive at the time they start a budget consolidation attempt. This is somehow contradictory to the crisis hypothesis. Conversely, the relatively high mean of the general government gross financial liabilities (row 16) and the maximum level of Japan (172.15% gross financial liability to

GDP) gives some support for the crisis hypothesis. Also interesting in this context is the rather high mean of the inflation-rate (row 20) and the mean of 4.59% for the real long-term interest rate (row 22). The relatively widely dispersed distribution of the inflation rates, indicated by the fairly high standard deviation, restricts us somewhat from drawing clear conclusions. The high real long-term interest rates do, however, support the theory that high interest payments on public debt may motivate politicians to initiate a budget consolidation attempt.

In the category of the macroeconomic variables, the change of real GDP (row 19) in connection with the change in short-term interest rates (row 21) and the change in unit-labour costs in the manufacturing sector (row 27) might provide us with further insights. Even though budget consolidation attempts are calculated from cyclically-adjusted data, it appears as if an improvement in the economy is supportive of consolidation attempts. In addition, an easing in the monetary policy also points towards an improvement in fiscal budgets. The tendency of an improving economy when initiating a budget consolidation attempt also provides a possible explanation for the propensity towards increasing unit-labour costs in the manufacturing sector. Lastly, the political variables need to be considered. The summary statistics indicate that the dispersion of the variable *Population over 65* (row 28) is relatively small. Therefore, the statistical explanatory power of this variable might be somewhat limited. Furthermore, the mean of 0.30 for the variable *Formation of the ruling government* (row 31) states that in 30% of the 79 observations a single party cabinet was in power and in 70% a coalition government was ruling. Finally, from rows 32 and 33 we can deviate that, in 39% of the observations a left wing, in 46% a right wing and in 15% a centre government, was in power.

Table 10: Summary statistics

	Variable	Obs.	Mean	Std. Dev.	Min	Max
1	Success variable for consolidation attempts (loose)	79	0.43	0.50	0.00 (N/A)	1.00 (N/A)
2	Cyclically-adjusted government primary balance	79	1.25	2.92	-6.61 (Norway)	7.13 (Finland)
3	Change in cyclically-adjusted government primary balance	79	2.36	1.11	1.28 (Canada)	6.86 (Netherlands)
4	Change in cyclically-adjusted primary receipts	79	1.02	1.22	-1.37 (Austria)	5.16 (Sweden)
5	Change in cyclically-adjusted taxes on production and imports	79	0.27	0.60	-2.14 (Sweden)	2.39 (New Zealand)
6	Change in cyclically-adjusted direct taxes on business	79	0.24	0.38	-1.04 (New Zealand)	1.50 (Finland)
7	Cyclically-adjusted direct taxes on households	79	0.32	0.60	-1.60 (New Zealand)	1.51 (Italy)
8	Change in cyclically-adjusted social security contributions received by general government	79	0.16	0.53	-1.02 (Netherlands)	2.39 (Sweden)
9	Change in cyclically-adjusted primary disbursements	79	-0.47	1.18	-2.85 (Finland)	4.53 (Iceland)
10	Change in cyclically-adjusted primary disbursements including net capital outlays of the government	79	-1.41	1.63	-6.84 (Netherlands)	3.53 (Sweden)
11	Change in social security benefits paid by general government	79	-0.16	0.54	-1.53 (Finland)	1.21 (Germany)

	Variable	Obs.	Mean	Std. Dev.	Min	Max
12	Change in subsidies paid by general government	79	-0.08	0.25	-0.75 (Finland)	0.74 (Ireland)
13	Change in government non-wage consumption	79	-0.04	0.33	-0.77 (Sweden)	0.90 (Austria)
14	Change in government wage consumption	79	-0.24	0.40	-1.21 (Belgium)	0.86 (Sweden)
15	Change in leading government wage consumption	79	-0.23	0.46	-1.16 (Denmark)	1.92 (Sweden)
16	General government gross financial liabilities	79	72.11	30.86	14.11 (Finland)	172.15 (Japan)
17	Change in government fixed capital formation	79	-0.17	0.31	-0.92 (Iceland)	0.80 (Iceland)
18	Change in unemployment rate	79	-0.21	12.34	-23.78 (Ireland)	45.21 (Netherlands)
19	Change in real GDP	79	2.75	1.97	-0.96 (Belgium)	9.45 (Ireland)
20	Inflation	79	4.11	3.73	-0.80 (Japan)	16.48 (Italy)
21	Change in short-term interest rate	79	-0.33	1.77	-4.35 (Sweden)	5.16 (Canada)
22	Real long-term interest rate	79	4.59	2.17	-0.64 (Sweden)	8.14 (Denmark)
23	Change in net exports	79	0.03	1.67	-6.62 (Iceland)	4.21 (Ireland)
24	Change in nominal effective exchange rate	79	0.41	5.14	-13.87 (Italy)	16.08 (United Kingdom)
25	Change in private consumption	79	0.05	0.69	-1.35 (New Zealand)	2.22 (Iceland)
26	Change in private fixed capital formation (private investments)	79	0.23	1.29	-3.39 (Iceland)	6.25 (Ireland)

	Variable	Obs.	Mean	Std. Dev.	Min	Max
27	Change in unit labour cost in the manufacturing sector	79	2.54	4.57	-7.16 (Sweden)	16.57 (Italy)
28	Population over 65	79	14.23	2.35	9.58 (Canada)	20.42 (Japan)
29	Herfindahl Index for Governments	79	0.65	0.27	0.22 (Belgium)	1.00 (several)
30	Corruption Index	79	5.23	0.96	2.00 (Ireland)	6.00 (several)
31	Formation of the ruling government	79	0.30	0.46	0.00 (N/A)	1.00 (N/A)
32	Left-wing government	79	0.39	0.49	0.00 (N/A)	1.00 (N/A)
33	Right-wing government	79	0.46	0.50	0.00 (N/A)	1.00 (N/A)

3.2 Methodology

3.2.1 Bayesian model averaging

The methodology applied in this paper is Bayesian model averaging. Bayesian model averaging is a statistical approach, which addresses model uncertainty. By calculating posterior distributions over coefficients and models, the method allows us to assess the robustness of outcomes compared to alternative model specifications (Draper, 1995). Even though the technique is not a new one – early work in the statistical literature related to model averaging includes Roberts (1965) and Leamer (1978), who presented the basic paradigm of BMA – Bayesian model averaging found its way into scientific research only in the mid-90s, when advances in methods and technology for posterior computation widened the scope for these methods (Clyde & George, 2004). [15] Montgomery and Nyhan (2010) describe three different environments for which BMA

[15] Since the mid-1990s Bayesian model averaging has been applied in different fields, such as economics (Fernandez, Ley & Steel, 2001), political science (Montgomery & Nyhan, 2010), biology (Yeung, Baumgartner & Raftery, 2005), ecology (Wintle, McCarthy, Volinsky & Kavanagh., 2003) and public health (Morales, Ibrahim, Chen & Ryan, 2006), to mention but a few.

can support the researcher with additional crucial information regarding the research topic:

- First, when the researcher has several competing measures of the same theoretical concept, BMA helps to find evidence for the most appropriate concept;
- Second, in case there is uncertainty over control variables, BMA can test for robustness of the estimates more systematically than is possible by applying conventional statistical regression models; and
- Third, BMA might deliver useful information in the case that the researcher has a large number of possible independent variables for which she wants to estimate the effects on an important dependent variable.

For this paper the third approach is followed. The dependent variable of interest is the success rate of fiscal consolidation attempts. The large set of independent variables consists of factors, as suggested by the literature on fiscal consolidation (cf. Section 2), which possibly have an effect on the success of fiscal consolidation attempts.

3.2.2 Theoretical concept of Bayesian model averaging

As already mentioned, Bayesian model averaging delivers a solution for model uncertainty in a canonical regression model. To start the explanation of the theoretical concept, suppose a normal linear regression function as follows:

$$y = \alpha_y + \beta_y X_y + \varepsilon \qquad \varepsilon \sim N(0, \sigma^2 I) \tag{1}$$

Y is the dependent variable, α_y a constant, β_y the coefficients for the independent variables X, and ε is a normal IID (independent and identically distributed) error term with variance σ^2. If a researcher wants to estimate y as correctly as possible, and if there are many variables X, the question arises as to which variables $X_y \in \{X\}$ should be included in a model. One approach would be to include all variables in a regression model; however, this might lead to inefficient, or even infeasible, results. To solve this problem, BMA estimates models for all possible combinations of X. The results of BMA are a weighted average over all the models (Zeugner, 2010). If there are K potential independent variables this results in 2^K possible variable combinations and consequently 2^K individual models.

In BMA the uncertainty regarding parameters and models is expressed in probabilities (see, for example, Leamer, 1978). Consequently, for all the inferences and the averaging process of all parameters, the basic rules of probability calculus, namely the definition of conditional probability, Bayes' theorem and the law of total probability, are applied. First, the averaging process, which incorporates the law of total probability, is presented:

$$p(\Delta|D) = \sum_{k=1}^{K} p(\Delta|D, M_k) * p(M_k|D) \tag{2}$$

In (2), Δ stands for any quantity of interest, such as an effect size, a future observable, or the utility of a course of action (Hoeting et al., 1999). We could assume, for example, that Δ stands for coefficients of the independent variable β_y, as stated in (1). In this case, $p(\Delta|D)$ is a probability distribution of β_y given data D. More formally, $p(\Delta|D)$ is the posterior probability for Δ (or β_y), where $p(\Delta|D, M_k)$ is the posterior distribution of Δ given the model M_k, and $p(M_k|D)$ is the posterior probability that M_k is the correct model (given that one of the models considered is the correct one). In other words, given data D, the BMA posterior probability distribution of Δ is the result of the average of all the posterior probabilities of Δ under each model, weighted by the posterior probability of the corresponding model (Raftery et al., 2005). Therefore, M_1, M_2,..., M_k are all the 2^K possible models.

Next, we need the posterior model probabilities for each model, which serve as an input variable in (2). At this point the Bayesian theorem comes into play.[16] The posterior model probability of each model M_k is given by:

$$p(M_k|D) = \frac{p(D|M_k) * p(M_k)}{\sum_{l=1}^{K} p(D|M_l) * p(M_l)} \tag{3}$$

[16] The Bayes' theorem is named after Thomas Bayes (1702-1761). His work was published by his friend Richard Price after his death in 1763 (see Bayes & Price, 1763). For a good introduction to Bayes statistics see, for example, Edwards, Lindman and Savage (1963), or Lee (2004). Equation (3) represents the simple form of the Bayes' theorem which can be expressed as: $P(A|B) = \frac{P(A|B) * P(A)}{P(B)}$

where $p(D|M_k)$ is the integrated likelihood of model M_k, which is explained in Equation (4). Furthermore, $p(M_k)$ is the prior probability that M_k is the true model (given that one of the considered models is the true one). The model prior has to be determined by the researcher and should reflect prior beliefs. The denominator presents the sum of the integrated likelihoods of all the models, weighted by their prior probabilities. This means that all models are implicitly conditional on the set of all models being considered. The term in the denominator is constant over all models (Zeugner, 2010).

In order to be able to calculate Equation (3) the integrated likelihood is needed. This term is obtained for each model by integrating over the unknown parameters, as follows:

$$\begin{aligned} p(D|M_k) &= \int p(D|\Theta_k, M_k) * p(\Theta|M_k) d\Theta_k \\ p(D|M_k) &= \int (likelihood * prior) d\Theta_k \end{aligned} \tag{4}$$

On the right hand side of the equation, Θ_k is the vector of parameters of model M_k (e.g., for regressions $\Theta = (\alpha, \beta, \sigma^2)$), $p(\Theta_k|M_k)$ is the prior density of vector Θ_k under model M_k and $p(D|\Theta_k, M_k)$ is the likelihood of Θ_k under model M_k. The integrated likelihood, as stated in (4), can be high-dimensional and, therefore, hard to calculate analytically. Nevertheless, as we will see later, there have been various analytical and numerical approximations proposed (Raftery, 1996).

Finally, if we know the posterior model probabilities, Equation (2) can be applied to calculate the BMA posterior mean of regression parameters, such as β_1 (in this case $\Delta = \beta_1$ in Equation (2)). The BMA posterior mean of β_1 is calculated as the weighted average of the posterior means of β_1 under each of the models:

$$E(\beta_1|D) = \sum_{k=1}^{K} \tilde{\beta}_1^{(k)} \; p(Mk|D) \tag{5}$$

This expression can be regarded as a model-averaged Bayesian point estimator. In Equation (5), $\tilde{\beta}_1^{(k)}$ is the posterior mean of β_1 under model M_k, and this can be approximated by the corresponding maximum likelihood estimator, $\hat{\beta}_1^{(k)}$ (Raftery, 1995).

Similar to the posterior mean, the posterior variance of β_1 can be calculated as follows:

$$Var(\beta_1|D) = \sum (Var(\beta 1|D, Mk) + \tilde{\beta}_k^2) p(Mk|D) - E(\beta 1|D)^2 \qquad (6)$$

The BMA standard deviation according to this equation can be viewed as a model-averaged Bayesian standard error (Draper, 1995). As we will see in the next subsection, the posterior mean and variance for each parameter β_y are part of the output in the big.glm-function, which is part of the statistical program “R”.

In summary, to implement Bayesian model averaging, the marginal distribution of the data, the prior probabilities of the models and the posterior distribution of the quantity of interest (e.g. β_y) conditional on each model are needed (Clyde, 1999). This seems to be straightforward, but there are three major issues which complicate the implementation. First, if there are many independent variables the number of terms in Equation (2) will be enormous, which makes a summation over all possible 2^K models infeasible. To solve this problem, different techniques, such as the modified leaps algorithm, Occam’s window, or Markov chain Monte Carlo model composition, have been implemented for the BMA computation (Raftery, Madigan & Hoeting, 1997).[17] Second, the integrals of the form (4) can be difficult to calculate. In linear regressions, closed form integrals for the marginal likelihood are available. For other classes of models, however, such as generalised linear models, which are used in this paper, approximations for the integrals are necessary. Three common approximation methods are based on the Akaike Infromation Criterion (AIC), the Bayes Information Criterion (BIC) and the Regularization Information Criterion (RIC) (George & Forster, 2000). In the next subsection we will introduce one of them; the Bayesian Information Criterion (BIC); which is used in the “R”-function that is applied in the empirical part of this paper. Finally, the specification of the prior probabilities over competing models can have a significant influence on the outcomes of BMA (Hoeting et al., 1999). Therefore, priors have to be chosen carefully.

[17] For more detail about the leaps and bounds algorithm see Volinsky, Madigan, Raftery and Kronmal (1997), or Furnival and Wilson (1974). A good description of Occam’s window can be found in Madigan and Raftery (1994). The Markov chain Monte Carlo model is introduced in Madigan and York (1995).

3.2.3 The bic.glm function

The statistical evaluations for BMA in this paper are calculated using R, which is a free software environment for statistical computing and graphics.[18] As the dependent variable in this thesis is of the form of a dummy variable, Bayesian model averaging for generalised linear models is necessary. Within R the bic.glm function, which is part of the package called BMA, was specifically designed to perform Bayesian model averaging for generalised linear models (for more details see Raftery, Hoeting, Painter, Volinsky & Yeung, 2011). The first part of the name for the function (bic) stands for the BIC approximation, which is applied to calculate the integral for the marginal likelihood. The second part of the name indicates that the function is used for generalised linear models (glm). The function incorporates several features to address the complexity issues in BMA. In the following, three of these issues will be discussed. First, prior probabilities are examined. Second, the leaps and bounds algorithm is described. Finally, the BIC approximation is introduced.

1. In the case where there is little prior information about the relative plausibility of the models, the neutral assumption that all models have the same prior probability is reasonable (Hoeting et al., 1999). When prior information about the importance of a variable is available, however, incorporating informative prior distributions may improve the quality of predictions in Bayesian model averaging (Spiegelhalter, Dawid, Lauritzen & Cowell, 1993). In the bic.glm function the prior probability on model M_k is specified as follows:

$$p(M_k) = \prod_{j=1}^{p} \pi_j^{\delta_{ij}} (1-\pi_j)^{1-\delta_{ij}} \tag{7}$$

   In this equation, $\pi_j \in [0,1]$ is the prior probability that $\beta_j \neq 0$ in a regression model and δ_{ij} is an indicator of whether or not variable j is included in model M_k. Assigning $\pi_j = 0.5$ for all j, results in a uniform prior across the model space. Choosing $\pi_j < 0.5$ penalises large models, while setting $\pi_j = 1$ forces variables into the model. This means that it is ensured that variable j is included in all models (Hoeting et al., 1999). The default setting in the big.glm

[18] The program can be downloaded free of charge from the internet page: http://www.r-project.org

function is $\pi_j = 0.5$, which puts a prior probability of 50% on all parameters β_j. If the researcher has prior information about the importance of the variables, however, she can either set π_j to any value between 0 and 1, which assigns the same prior probability between 0 and 100% to all β_j, or she can specify a vector with separate prior probabilities for each parameter β_j (Raftery et al., 2011).

2. If there are k independent variables, the number of models in Equation 2 can be enormous (the number of models is calculated as 2^K), however, a large number of these models are only weakly supported by the data. Consequently, Madigan and Raftery (1994) suggested averaging only over the best models, as an approximation to averaging over all 2^K models. The definition of which are the best models is formulated by the posterior probability. As a result, models which do not belong to:

$$A = \left\{ M_k : \frac{\max_l \{p(M_l|D)\}}{p(M_k|D)} \le C \right\} \tag{8}$$

should be excluded from Equation (2). In the function bic.glm, C can be chosen by the researcher, and depends on the context of the problem at hand. If, for example, the researcher chooses $C = 20$, Equation (2) averages only over models which exhibit a posterior model probability of at least $\frac{1}{20}$ of the posterior probability of the best model. In the big.glm function, the best model is defined as the one with the largest BIC, which corresponds to the model with the highest posterior model probability (Volinsky et al., 1997). What is now required is a search strategy to identify the models in A. The challenge is to find a quick way of screening the models, without fitting them all, and filtering those models out which are close in posterior probability to the best model. The big.glm function allows for two procedures, which incorporate Equation (8). By default it applies the leaps and bounds algorithm. To further reduce the number of models over which Equation (2) averages, Occam's window can be used as an option. As the computational capacity was still strong enough to handle the number of independent variables of the dataset used in this paper, only the leaps and bounds algorithm was applied in Section 4.

3. Finally, in the big.glm function, the integrated likelihood in Equation (4) is approximated via the Laplace method (Raftery, 1996). The result of this method is:

$$\log p(D|M_k) = \log p(D|\hat{\Theta}_k, M_k) - (d_k / 2)\log n + O(1) = BIC_k \qquad (9)$$

where n is the number of records in the data and d_k is the number of parameters in model M_k. $\hat{\Theta}_k$ is the maximum likelihood estimator, which is equal to the least squares estimator for linear estimation coefficients (Raftery et al., 2005). $O(1)$ is the error term. Equation (9) represents the Bayesian information criterion (BIC) approximation, which was first derived by Schwartz (1978). The good aspect of this approximation approach is that, for linear regressions, BIC can be simplified as:

$$BIC_k = n\log(1 - R_k^2) + p_k \log n \qquad (10)$$

Where R_k^2 is the value of R^2 and p_k is the number of regressors for the kth regression model. With this formula BIC is nothing but an additive constant. For the null model with no regressors, for instance, the constant would be $BIC_k = 0$ (Raftery et al., 2005). At this stage we will not go deeper into detail regarding the BIC approximation. It is, however, important to mention that the Bayesian information criterion provides a sufficient approximation of the integrated likelihood (Hoeting et al., 1999). Therefore, it can be assumed that the results in Sections 4 and 5, which are calculated using the bic.glm function, are accurate and reliable.

4 Results

4.1 BMA with dependent variable loose criterion

The results following in this section were calculated with the bic.glm function, which was outlined in the previous section. The data input matrix consists of the dependent success variable, calculated according to the *loose criterion,* and the 31 independent variables introduced in Subsection 3.1.3. As there was no plausible prior information we stayed with the neutral assumption that all models have the same prior probability (Hoeting et al., 1999). Accordingly, we applied the default setting in the big.glm function, which puts a prior probability of 50% on all parameters β_j. Furthermore, with only 31 independent variables, the computing power was still strong enough to use the leaps and bounds algorithm. Hence, there was no need for another method such as, for instance, Occam's window, to further reduce the number of models over which BMA is applied. Moreover, we set the parameter C to 10,000. This leads to the result that the averaging process only models, which exhibit a posterior model probability of at least $\frac{1}{10,000}$ of the posterior probability of the best model, were considered. By applying this process, 1,382 models were selected, as indicated at the top left corner of Table 11. Increasing C further did not result in a major improvement of the results. Conversely, however, a decrease in C rapidly reduced the number of the selected models. Therefore, setting the selection window to $\frac{1}{10,000}$ seems to deliver reasonable results.

In Table 11, the BMA results of the main calculations are summarised. As already mentioned, the leaps and bounds algorithm selected 1,382 models over which BMA was applied. The parameter estimates for the top five models are indicated in the five rightmost columns. For the best 2 models three variables were selected, with Models 3 to 5 each consisting of four variables (indicated in row nVar). The results of the Bayesian information criterion (BIC) are listed in the second to last row. The higher the absolute $|BIC|$ value, which is an approximation for the integrated likelihood, the higher the posterior probability for the model. This can be checked by inserting the BIC value into Equation (4). In Equation (4) the minus signs will cancel out. Hence, only the absolute value of BIC matters. Moreover, in the last row the posterior probabilities of the five best models can be retrieved. In our case, Model 1 has a posterior probability of

5.1% and the second best model achieved a posterior probability of 4.9%. The sum of the posterior probability of the best five models is listed in the second row from the top. According to this figure, the top five models account for 18.2% of the total posterior probability. The column at the left-hand side states the short-name of the respective independent variable. Next, the column headed p!=0 shows the posterior probability that the variable is in the model. The values are indicated in percentages and the calculation is performed according to Equation 2. Furthermore, the column headed EV shows the BMA posterior mean, and the column named SD shows the posterior standard deviation for each variable. The values of these two columns are calculated with Equations (5) and (6), respectively.

Table 11: BMA results with dependent variable *loose*

1382 models were selected
Best 5 models (cumulative posterior probability = 0.1815):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-3.702	2.11	-1.58	-3.19	-1.52	-4.43	-2.89
cy_bal_pr	5.2	0.005	0.03	.	.	.	.	.
Δcy_bal_pr	13.1	0.069	0.22	.	.	.	.	.
Δcy_rec_ex	2.9	-0.003	0.06	.	.	.	.	.
Δcy_tx_prod	7.9	0.087	0.35	.	.	.	.	.
Δcy_tx_bus	2.6	-0.023	0.21	.	.	.	.	.
Δcy_tx_hh	4.1	-0.032	0.19	.	.	.	.	.
Δcy_soc_con	3.0	-0.024	0.19	.	.	.	.	.
Δcy_dis_pr	3.4	-0.002	0.07	.	.	.	.	.
Δcy_dis_prca	3.8	-0.011	0.07	.	.	.	.	.
Δgv_soc_ben	99.3	-2.616	0.92	-2.68	-2.87	-1.97	-2.80	-2.23
Δgv_subs	2.5	-0.030	0.27	.	.	.	.	.
Δgv_nwg_con	2.0	-0.011	0.15	.	.	.	.	.
Δgv_wg_con	3.9	-0.048	0.29	.	.	.	.	.
gv_gr_liab	5.4	0.000	0.00	.	.	.	.	.
Δgv_cp_frm	2.6	0.013	0.19	.	.	.	.	.
Δunempl	16.2	-0.008	0.02	.	.	-0.06	.	-0.05
Δgdp_real	1.8	0.002	0.03	.	.	.	.	.
inflation	2.9	0.003	0.03	.	.	.	.	.
Δshort_ir	91.6	-0.523	0.26	-0.58	-0.63	-0.61	-0.53	-0.65
long_ir_real	49.2	0.144	0.19	.	.	.	0.26	.
Δnet_exp	2.9	0.005	0.06	.	.	.	.	.
Δexch_eff	1.4	0.000	0.01	.	.	.	.	.
Δprv_cons	6.1	0.030	0.18	.	.	.	.	.
Δprv_cp_frm	1.8	0.001	0.03	.	.	.	.	.
Δunt_lb_cst	1.8	0.001	0.01	.	.	.	.	.
pop_65over	3.0	0.003	0.03	.	.	.	.	.
herf_gov	74.2	2.412	1.88	.	3.19	.	3.29	2.77
corruption	3.8	0.008	0.08	.	.	.	.	.
gov_form	16.6	0.227	0.67	1.84	.	1.69	.	.
gov_left	6.3	0.055	0.26	.	.	.	.	.
gov_right	4.4	-0.030	0.19	.	.	.	.	.
nVar				3	3	4	4	4
BIC				-252.31	-252.24	-251.58	-250.81	-250.73
post prob				0.051	0.049	0.035	0.024	0.023

The matrix form of Table 11 allows us to analyse the results from two perspectives. On the vertical line, posterior model probabilities are provided and, on the horizontal axis, the posterior probabilities of each independent variable are shown. First, we will focus on the model view. Table 11 presents the five models with the highest posterior model probability.[19] This information gives an indication about the combination of variables with the highest explanatory power for the independent variable (success of fiscal consolidation attempts). When interpreting these results, however, we have to be careful because the best models are only the best ones from a relative point of view. Consequently, the insights are somewhat limited by the low posterior model probabilities of the best models in absolute terms. The first ranked model reached only a posterior probability of 5.1% and the second best model has a posterior probability of 4.9%; just 0.2% behind. Therefore, even though Model 1 exhibits the highest posterior model probability a likelihood of $\frac{1}{20}$ is not very strong support for this model. More informative values can be drawn from the separate findings on the independent variables.

For the independent variables the posterior probability of being in the model is of most interest.[20] In Table 11, the three variables with a posterior probability above 50% are: *Change in social security benefits paid by general government*; *Change in short-term interest rate*; and the *Herfindahl Index for Governments*. The 99.3% posterior probability of the variable *Change in social security benefits paid by general government* indicates that it is almost certain that this variable has to be in the model. Furthermore, the negative sign of the BMA posterior mean indicates that the relation between government social spending and the success rate of budget consolidation attempts is an inverse one. This finding is in line with what the literature states regarding the success of budget consolidation attempts and government spending (cf. Subsection 2.2). Alesina and Perotti (1996), in particular, identified in their paper that cuts in social transfer payments are more likely to promote long-lasting consolidations. With a posterior probability of 91.6%, the variable *Change in short-term interest rate*

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[19] Appendix D provides a visual summary of all models selected by BMA.

[20] A graphical illustration of the posterior distribution for each of the 31 coefficients of the independent variables is attached in Appendix C.

comes second. Also, for this variable, the inverse relation is sensible. Accordingly, an easing monetary policy seems to be supportive for a consolidation of the fiscal budget. This confirms the results of Ahrend et al. (2006), who found that a supporting monetary policy stance at the inception of the fiscal consolidation leads to longer lasting and larger consolidation achievements. Finally, the third variable that reached a posterior probability above 50% is the Herfindahl Index for governments. The higher the Herfindahl Index, the less fragmented a government is. Hence, the positive relation between the index and the independent variable indicates that, the less fragmented the government is, the more likely a successful budget consolidation is. These results are backed by previous research. For instance, Alesina et al. (2006) found that budget stabilisation is more likely if the ruling party holds a large majority.

Besides the three variables with the highest posterior probability some other variables exhibit interesting characteristics. First, the variable *Formation of the ruling government* does appear in the best model, but there is nevertheless a great deal of uncertainty about whether it should be included (relatively low posterior probability of 16.6%). The variable is equal to 1 if a single party cabinet is in power and 0 if a coalition cabinet is in power. Consequently, this variable is highly correlated with the Herfindahl Index for governments. This leads to the result that the models favoured by BMA include one, or the other, variable, but not both (Raftery et al., 2005). As we will explain in the subsection regarding the robustness check, the posterior probability of the variable *Formation of the ruling government* will increase and the posterior probability of the Herfindahl Index will decrease when applying the stricter criterion for the success variable. Second, with a posterior probability slightly below 50%, the variable *Real long-term interest rate* achieved the fourth highest result. The positive sign of this variable can be explained by the crisis hypothesis (cf. Alesina & Drazen, 1991). Accordingly, the higher the risk premium on long-term government debt, the higher the pressure on governments to find a feasible solution to budget consolidation issues. Therefore, high interest rates tend to positively influence the success rate of budget consolidation attempts. Finally, there are two other variables with a posterior probability over 10%. These are *Change in cyclically-adjusted government primary balance* and *Change in unemployment rate*. The posterior probabilities, at 13.1% and 16.2% respectively, are not really significant. Nevertheless, for these variables, the signs of the BMA posterior means are also sensible. On the one hand, the higher the change in the cyclically-adjusted government primary balance, the more likely a successful budget consolidation is (cf. Subsection 2.2). On the other hand, a decrease in the unemployment rate tends to favour a sustainable fiscal budget improvement.

4.2 BMA with dependent variable loose criterion and leading government wage consumption

A strong argument in Alesina and Perotti (1996) is that cuts in government wages are an important factor for a successful budget consolidation. As we used the same method as Alesina and Perotti (1996) to calculate the success variable, we were surprised by the low posterior probability of only 3.9% achieved by the variable *Change in government wage consumption* in the previous subsection (cf. Table 11). The sign of the variable, which points in the right direction, made us slightly more optimistic. Namely, the negative relation between the independent variable and the dependent variable indicates that a decrease in government wages tends to increase the chance of a successful budget consolidation. As we did not want to reject Alesina and Perotti's (1996) hypothesis a priori we run a BMA regression with an alternative variable for changes in government wages. The original variable, *Change in government wage consumption,* was exchanged with the variable *Change in leading government wage consumption*. The new variable measures the change in government wage expenditure in the year following the consolidation attempt. The reasoning for the switch is based on the assumption that government wages cannot be adjusted instantly when a government initiates a budget consolidation attempt, because wage adjustments are subject to a political process. Therefore, it may take some time for a feasible solution to be found for all parties involved (Alesina, 2010). The results with the leading variable for the change in government wages are summarised in Table 12.

First, as indicated at the top right hand corner of Table 12, the number of selected models over which the BMA was run did not change with the new variable. Furthermore, the variables *Change in social security benefits paid by general government*, *Change in short-term interest rate* and the *Herfindahl Index for Governments* still have the highest posterior variables, even though the posterior probabilities for all of them decrease to some extent. Also, nothing has changed in the composition of the top five models. The posterior model probabilities do, however, drop slightly for all five models. This also explains why the posterior probabilities of the variables have decreased. Finally, we are, of course, interested in how the results have changed for the new variable. Highlighted in orange, it is shown in Table 12 that the posterior probability for the government wage variable increased from 3.9% to 18%. This is quite an impressive improvement, but the overall significance of the variable is still low. In addition, the variable did not appear in one of the top five models. To further test Alesina and Perotti's (1996) hypothesis, checks using two years' and three years' leading variables for government wage consumption were performed. None of the tests of the posterior probabilities of the wage variable reached a significant level. Therefore, we can conclude that, based on our dataset, there is only a low probability that a variable accounting for changes in the government's wage consumption will be included in a model.

Table 12: BMA results with dependent variable *loose* and leading government wage consumption

1382 models were selected
Best 5 models (cumulative posterior probability 0.1595):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100.0	-3.317	1.96	-1.58	-3.19	-1.52	-4.43	-2.89
cy_bal_pr	8.9	0.009	0.04	.	.	.	.	.
Δcy_bal_pr	5.4	0.027	0.14	.	.	.	.	.
Δcy_rec_ex	2.3	-0.001	0.05	.	.	.	.	.
Δcy_tx_prod	7.5	0.085	0.36	.	.	.	.	.
Δcy_tx_bus	2.7	-0.023	0.20	.	.	.	.	.
Δcy_tx_hh	3.3	-0.025	0.17	.	.	.	.	.
Δcy_soc_con	6.1	-0.046	0.26	.	.	.	.	.
Δcy_dis_pr	2.3	-0.002	0.05	.	.	.	.	.
Δcy_dis_prca	3.9	-0.011	0.07	.	.	.	.	.
Δgv_soc_ben	97.7	-2.444	0.98	-2.68	-2.87	-1.97	-2.80	-2.23
Δgv_subs	3.8	-0.042	0.33	.	.	.	.	.
Δgv_nwg_con	1.4	-0.009	0.13	.	.	.	.	.
Δgv_wg_con_lead	18.0	-0.370	0.89	.	.	.	.	.
gv_gr_liab	3.8	0.000	0.00	.	.	.	.	.
Δgv_cp_frm	2.3	0.017	0.24	.	.	.	.	.
Δunempl	23.6	-0.014	0.03	.	.	-0.06	.	-0.05
Δgdp_real	1.7	0.002	0.03	.	.	.	.	.
inflation	1.9	0.002	0.02	.	.	.	.	.
Δshort_ir	81.0	-0.460	0.30	-0.58	-0.63	-0.61	-0.53	-0.65
long_ir_real	39.6	0.116	0.18	.	.	.	0.26	.
Δnet_exp	2.8	0.007	0.07	.	.	.	.	.
Δexch_eff	1.2	0.000	0.01	.	.	.	.	.
Δprv_cons	6.1	0.033	0.19	.	.	.	.	.
Δprv_cp_frm	1.4	0.000	0.03	.	.	.	.	.
Δunt_lb_cst	1.5	0.001	0.01	.	.	.	.	.
pop_65over	3.6	0.004	0.03	.	.	.	.	.
herf_gov	68.4	2.119	1.83	.	3.19	.	3.29	2.77
corruption	2.2	0.006	0.06	.	.	.	.	.
gov_form	14.8	0.221	0.65	1.84	.	1.69	.	.
gov_left	5.6	0.051	0.26	.	.	.	.	.
gov_right	2.3	-0.015	0.13	.	.	.	.	.
nVar				3	3	4	4	4
BIC				-252.31	-252.24	-251.58	-250.81	-250.73
post prob				0.045	0.043	0.031	0.021	0.020

5 Robustness checks

5.1 BMA with dependent variable strict criterion

Having seen interesting results using the success variable calculated with the *loose criterion*, robustness checks were performed with the stricter independent variable. It should be remembered that, according to the definition for the *strict criterion,* the cyclically-adjusted primary deficit has to fall by 2% of GDP in one year, or at least 1.5% per year in two consecutive years to be counted as a consolidation attempt. For the success rate the same definition was applied for both variables. This resulted in 52 consolidation attempts, out of which 26 were successful for the *strict variable* compared to 79 consolidation attempts and 34 successes for the *loose variable*. On the right hand side of the equation, the same 31 independent variables were applied for the robustness check as for the main results in the previous section. For settings in the bic.glm function only one parameter was slightly changed. As the model did not fit well, with a too wide window for the leaps and bounds algorithm, the parameter C was set to 1,000 instead of 10,000. The outcome of this is a smaller number in the models selected, which is indicated in the first row of Table 13.

Interestingly, when applying the stricter criterion in calculating BMA, the posterior model probability of the best five models still remains very low. The best model achieves only a posterior probability of 3.4% and the five top models together only add up to 14.3% of posterior probability. For that reason, once again, these results on the vertical axis have to be carefully interpreted. Even though the models appear on top of the list compared to all the BMA calculated models, the likelihood that they are the correct ones is very low. What is also interesting, besides the posterior probabilities, is the number of variables in the five leading models. Similar to the results with the *loose criterion,* BMA selected either three, or four, variables for each model. The variables with the highest posterior probabilities have, however, changed.

On the horizontal level, only the two variables *Real long-term interest rate* and *Cyclically-adjusted direct taxes on households* reached a posterior probability higher than 50%. With posterior probabilities of 98.4% and 70.4%, respectively, the likelihood of being included in the model is very high for both variables. In addition, the signs of the variables show interesting characteristics. The positive relation between the real long-term interest rate and the success rate of fiscal consolidation attempts has already been discussed above. Therein, the behaviour of the variable was attributed to the crises hypothesis (cf. Alesina & Drazen, 1991). In contrast, direct taxes on households exhibit an inverse relation with successful budget consolidations. On first examination this might appear contra-intuitive. One might think that higher taxes will help to improve the budget deficit. It has, however, been shown in several studies that fiscal consolidation relying on tax increases is typically short-lived (cf. for example Alesina & Ardagna, 1998). The reverse logic that tax cuts might even improve the fiscal budget can be explained by the influence on the economic output. There are explanations for the demand side, as well as the supply side effects. On the demand side, a decrease in direct private taxes increases private wealth. Consequently, private consumption is likely to increase (Frank & Bernanke, 2009). The supply side effect works through increased private income when taxes are cut. The higher income leads to an increased labour supply, which has a positive effect on economic output (Taylor, 2007). What is also remarkable is that, even though the variable *Cyclically-adjusted direct taxes on households* exhibits high posterior probability, the variable does not appear in the best model. This confirms our view that, due to the low posterior model probability, more insights can be gained by analysing the individual variables rather than the whole models. Finally, the variable *Formation of the ruling government* achieved a posterior probability of just below 50%. This supports the hypothesis that budget stabilisation is more likely if the ruling party holds a large majority (Alesina et al., 2006).

In Table 13, the three variables which achieved the highest posterior probability in the BMA calculations with the *loose independent variable* are highlighted in orange. For all of the three variables the posterior probability dropped greatly, but did not fall below 10%. Moreover, the variables *Change in social security benefits paid by general government* and *Change in short-term interest rate* still appear in some of the best models. In contrast, the coefficient of the Herfindahl Index did not only disappear in the list of the best models, but also changed the sign. This is only mentioned, however, as a side note, because the probability of being included in the model is no longer significant. To summarise, the robustness check confirms that there is some justification to include the variables *Change in social security benefits paid by general government* and *Change in short-term interest rate* in a model to explain successful consolidation attempts. Furthermore, a decrease in social contribution paid and the short-term interest rate are likely to be supportive of a successful consolidation. As the Herfindahl Index for Government and the variable *Formation of the ruling government* are highly correlated, it is also likely that a variable for the formation of the government should be included in the model. In addition, the results provide evidence that the less fragmented the government, the more likely a successful budget consolidation is.

Table 13: BMA results with dependent variable *strict criterion*

650 models were selected
Best 5 models (cumulative posterior probability = 0.1433):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-4.072	3.04	-3.65	-7.89	-3.50	-3.69	-3.99
cy_bal_pr	1.4	0.002	0.02	.	.	.	.	.
Δcy_bal_pr	2.8	-0.002	0.06	.	.	.	.	.
Δcy_rec_ex	3.5	0.008	0.16	.	.	.	.	.
Δcy_tx_prod	2.0	0.030	0.32	.	.	.	.	.
Δcy_tx_bus	2.8	-0.003	0.18	.	.	.	.	.
Δcy_tx_hh	70.2	-1.364	1.18	.	-2.16	-2.28	-1.46	-1.38
Δcy_soc_con	9.1	-0.139	0.55	.	.	.	.	.
Δcy_dis_pr	15.7	-0.091	0.26	.	.	.	.	.
Δcy_dis_prca	3.1	-0.001	0.06	.	.	.	.	.
Δgv_soc_ben	13.6	-0.182	0.53	-1.41	.	.	.	-1.29
Δgv_subs	6.2	-0.167	0.78	.	.	.	.	.
Δgv_nwg_con	3.3	-0.041	0.36	.	.	.	.	.
Δgv_wg_con	5.9	-0.064	0.37	.	.	.	.	.
gv_gr_liab	5.3	0.001	0.01	.	.	.	.	.
Δgv_cp_frm	18.9	0.461	1.17	.	.	.	.	.
Δunempl	1.8	-0.001	0.01	.	.	.	.	.
Δgdp_real	4.8	0.012	0.09	.	.	.	.	.
inflation	1.4	-0.001	0.02	.	.	.	.	.
Δshort_ir	24.5	-0.142	0.29	.	-0.61	-0.73	.	.
long_ir_real	98.4	0.754	0.30	0.59	0.68	0.86	0.81	0.80
Δnet_exp	0.8	0.001	0.02	.	.	.	.	.
Δexch_eff	5.9	0.010	0.05	.	.	0.18	.	.
Δprv_cons	0.9	0.003	0.07	.	.	.	.	.
Δprv_cp_frm	2.8	-0.001	0.06	.	.	.	.	.
Δunt_lb_cst	1.0	0.000	0.01	.	.	.	.	.
pop_65over	1.3	-0.002	0.03	.	.	.	.	.
herf_gov	16.2	-0.172	1.19	.	.	.	.	.
corruption	11.6	0.136	0.45	.	1.01	.	.	.
gov_form	44.5	1.242	1.69	3.13	.	.	2.15	2.62
gov_left	2.5	0.032	0.24	.	.	.	.	.
gov_right	1.0	-0.007	0.11	.	.	.	.	.
nVar				3	4	4	3	4
BIC				-145.68	-145.53	-145.27	-145.13	-145.11
post prob				0.034	0.031	0.027	0.026	0.025

5.2 BMA with fiscal, macroeconomic and political independent variables separated

In order to find further evidence for the main results, robustness checks with a smaller number of independent variables were carried out. For this reason, we divided the independent variables into the following three categories; fiscal, macroeconomic, and political. On the left hand side of the equation, the independent variable calculated according to the *loose criterion* was applied. Therefore, each dataset consists of 79 observations. In addition, the parameters of the bic.glm function were the same as for the main results in Subsection 4.1.

With only the 15 independent fiscal variables in the input matrix, the leaps and bounds algorithm selected 1,520 models for the averaging process (cf. Table 14). The five best models account for 18.1% of the posterior probability. Interestingly, the first model achieved 8.4% of the posterior probability, while the probabilities dropped considerably thereafter. A posterior probability below 10% is, however, still insignificant. Furthermore, each model contains only either one, or two, variables. On the horizontal axis the variable *Change in social security benefits paid by general government* achieved the highest posterior probability. This variable is also the only one that made it above the threshold of 50%. This result confirms that a reduction in government social spending is an important factor in reducing the fiscal budget deficit in a sustainable manner. The variable *Cyclically-adjusted direct taxes on households*, which achieved a high posterior probability in the first robustness check, is no longer significant. Nevertheless, the sign still points in the same direction. Another variable worth mentioning is *Change in government wage consumption*. In Subsection 4.2 we found no confirmation of the hypothesis of Alesina and Perotti (1996); which stated that cuts in government wages contribute positively to successful budget consolidations. With a rather low posterior probability of only 22% not even the focus solely on fiscal variables brings further evidence that this variable should be included in the model.

Table 14: BMA results with only fiscal independent variables

1520 models were selected
Best 5 models (cumulative posterior probability = 0.1812):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-1.057	0.81	-0.64	-1.59	-0.87	-0.93	-0.48
cy_bal_pr	5.2	0.002	0.02	.	.	.	.	.
Δcy_bal_pr	9.1	0.020	0.10	.	.	.	.	.
Δcy_rec_ex	6.2	-0.006	0.08	.	.	.	.	.
Δcy_tx_prod	18.6	0.142	0.39	.	.	.	.	.
Δcy_tx_bus	11.8	-0.091	0.37	.	.	.	.	.
Δcy_tx_hh	7.9	-0.033	0.17	.	.	.	.	.
Δcy_soc_con	19.5	-0.182	0.49	.	.	.	.	-0.79
Δcy_dis_pr	14.9	-0.050	0.22	.	.	.	.	.
Δcy_dis_prca	11.3	-0.022	0.09	.	.	.	-0.22	.
Δgv_soc_ben	87.2	-1.577	0.89	-1.82	-2.05	-1.65	-1.66	-1.50
Δgv_subs	22.8	-0.384	0.92	.	.	.	.	.
Δgv_nwg_con	20.4	-0.296	0.75	.	.	.	.	.
Δgv_wg_con	22	-0.242	0.60	.	.	-0.96	.	.
gv_gr_liab	24.8	0.004	0.01	.	0.01	.	.	.
Δgv_cp_frm	5.4	-0.012	0.21	.	.	.	.	.
nVar				1	2	2	2	2
BIC				-242.38	-240.15	-240.11	-239.65	-239.64
post prob				0.084	0.027	0.027	0.021	0.021

Focusing only on macroeconomic factors leaves us with 10 independent variables. The BMA calculation selected 802 models for the averaging process (cf. Table 15). Notably, with the lower number of independent variables, the posterior probability of the first 5 models increased to 36.6%. Moreover, the first model captures almost all of the posterior model probability, whereas afterwards the probabilities fall rapidly. With only 18.2% posterior model probability for the best model, the chance that it is the correct model is still quite low. Furthermore, all models contain either two, or three, variables. On the horizontal line, two variables are clearly above 50%. To be specific, these are the variables *Change in unemployment rate* and *Change in short-term interest rate*. The high posterior probability of 89.6% for the change in the unemployment rate might be a little surprising, because the variable was not significant in the main BMA results discussed in Subsection 4.1. Nevertheless, the variable was amongst the top three macro variables and, what is more, the signs point towards the same direction as in the main results. Accordingly, a decrease in the unemployment rate is supportive of a successful budget consolidation. This makes sense since lower unemployment compensation payments bring some relief for the government's spending side; namely, through the government's social contributions paid. Hence, there is some correlation in the dataset between the variable *Change in unemployment rate* and *Change in social security benefits paid by general government*. Given that, in the figures for social security benefits paid, transfer payments other than unemployment compensations are included and, because the variable is adjusted for the economic cycle, the correlation between the change in unemployment rate and security benefits paid is not perfect. The other variable that confirms our main results is the *Change in short-term interest rate*. The posterior probability of 85.5% and the inverse relation with a sustainable budget consolidation underline the hypothesis that an easing monetary policy helps the central government in its efforts to improve the budget. Finally, the result for the variable *Real long-term interest rate* is not very strong, but does, however, underscore the findings from the first robustness check carried out using the stricter independent variable.

Table 15: BMA results with only macroeconomic independent variables

802 models were selected
Best 5 models (cumulative posterior probability 0.3664):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-1.326	0.92	-0.62	-1.67	-1.42	-1.95	-0.67
Δunempl	89.6	-0.077	0.04	-0.10	-0.09	-0.07	-0.07	-0.10
Δgdp_real	31.7	0.104	0.19	.	.	0.28	.	.
inflation	11.4	-0.003	0.04	.	.	.	.	.
Δshort_ir	85.5	-0.443	0.26	-0.55	-0.44	-0.59	.	-0.55
long_ir_real	39.2	0.104	0.16	.	0.24	.	0.33	.
Δnet_exp	12	0.012	0.08	.	.	.	.	.
Δexch_eff	13.9	0.006	0.03	.	.	.	.	0.05
Δprv_cons	10.9	0.013	0.16	.	.	.	.	.
Δprv_cp_frm	11.1	0.011	0.08	.	.	.	.	.
Δunt_lb_cst	13	-0.007	0.03	.	.	.	.	.
nVar				2	3	3	2	3
BIC				-246.76	-245.35	-244.87	-243.51	-243.39
post prob				0.182	0.090	0.071	0.036	0.034

The last category of independent variables we test consists of the six political variables. As shown in Table 16, the bic.glm formula selected 64 models for BMA. What is more, the cumulative posterior probability achieved a respectable 46.5%. This time, the probabilities are distributed more evenly than in the previous two calculations for the fiscal and macroeconomic variables. In addition, the models are built using only a few variables. The fifth best model is, in fact, comprised of only the constant term of the regression. Here, however, we would also like to focus more on the individual variables than on the models.

Interestingly, none of the variables achieved a posterior probability above 50%. The two variables with the highest probabilities are *Corruption Index* and *Formation of the ruling government*, with 48.4% and 45.3%, respectively. The positive sign of the coefficient of the corruption index indicates that the less corrupt a country is, the higher the chances are of a successful budget adjustment. This result is in line with the research of Arin et al. (2011). They argue that corrupt governments are less likely to succeed when trying to consolidate their fiscal budget; mainly because corrupt governments try to keep the expenditure side large in order to serve the interests of important lobbyist groups. Next, the sign of the coefficient which accounts for government formation confirms the main results. Identical with the Herfindahl Index, the variables indicate that the more unified the government, the more likely a sustainable budget alignment. Lastly, Table 16 shows that the variable *Left-wing government* is in the model with a probability of almost 30%. The sign also suggests a positive relation with the success variable. This result, in combination with the outcome of the previous BMA calculations, is in line with the findings of Tavares (2004). He argued that left wing governments are more successful in adjusting the fiscal budget through spending cuts. The previous results showed that a reduction in government social benefit spending increases the chance of a successful budget consolidation. Consequently, it makes also perfect sense that the likelihood of a successful fiscal budget adjustment increases if, at the same time, a left wing government is in power.

Table 16: BMA results with only political independent variables

64 models were selected
Best 5 models (cumulative posterior probability 0.4652):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-2.415	2.34	-0.64	-3.57	-0.69	-3.27	-0.28
pop_65over	16.5	0.019	0.06	.	.	.	.	.
herf_gov	21.9	0.231	0.80	.	.	.	.	.
corruption	48.4	0.276	0.35	.	0.55	.	0.57	.
gov_form	45.3	0.516	0.70	1.15	1.14	.	.	.
gov_left	29.8	0.263	0.51	.	.	1.02	.	.
gov_right	13.1	-0.020	0.26	.	.	.	.	.
nVar				1	2	1	1	0
BIC				-233.79	-233.69	-233.18	-233.11	-232.84
post prob				0.116	0.110	0.085	0.082	0.072

5.3 BMA with dependent variable from Alesina and Ardagna (2010)

As a last robustness check we took the observations for the dependent success variable from a recent paper published by Alesina and Ardagna (2010), and run BMA with all the 31 independent variables. This paper was chosen as a reference since it is one of the rare publications in which the authors released the countries and years for fiscal adjustment, and the corresponding success rates. Even though the calculation of the adjustment periods and the success rate were done in a similar way as in this thesis, there are some small, but important differences, which are discussed below. A year which counts as a fiscal adjustment period was defined by Alesina and Ardagna (2010, p. 8) as follows:

"A period of fiscal adjustment is a year in which the cyclically-adjusted primary balance improves by at least 1.5% of GDP."

This definition focuses only on one year and, therefore, it is slightly stricter than the one we used for the loosely defined independent variable. Besides this, the adjustment for cyclical effects was carried out in a slightly different way than in our research. Unfortunately, the authors did not comment on the exact method they applied. To evaluate the successful adjustments, the following definition was applied (Alesina & Ardagna, 2010, p. 9):

"A period of fiscal adjustment is successful if the cumulative reduction of the Debt to GDP ratio three years after the beginning of a fiscal adjustment is greater than 4.5 percentage points."

In contrast to the definition used in Subsection 4.1, this definition only considers the debt to GDP ratio and completely neglects the change in the cyclically-adjusted primary deficit. In return, this definition is somewhat more generous in the sense that the debt to GDP ratio has only to improve by 4.5% instead of 5%. Matching the data from Alesina and Ardagna's (2010) paper with our data we ended up with 104 adjustment periods, of which 19 were successful. Due to insufficient data availability 23 observations had to be dropped. Eventually, the dataset encompasses 81 adjustment periods, including 16 successful ones. The exact listing of the observations is attached in Appendix E. At this point we would like to stress the small number of successful adjustment (17) attempts compared to unsuccessful ones (65). In contrast, in the main dataset there were 34 successes to 45 failures. This fact might explain some of the differences in the BMA results, as listed in Table 17.

For this robustness check we run BMA with the same parameter settings as for the main results in Subsection 4.1. Through the application of this method, the leaps and bounds algorithm selected 1,382 models. Compared to the previous calculations, the low posterior probability of the best 5 models is somewhat surprising. The best model only achieved a probability of 1.1%. Interestingly, however, the following 4 models did not perform much worse. Furthermore, this time the best models consist of more variables than in the earlier calculations. Because of the low significance of the best models we prefer to place the focus on the individual variables.

Due to the fact that the best models consist of a larger number of variables, more variables reached a posterior probability above the threshold of 50%. Surprisingly, 2 of the 3 variables that achieved a high posterior probability in the main results also made it above the threshold in this robustness check. These are the variables *Herfindahl Index for Governments* and *Change in social security benefits paid by general government*. The third variable, *Change in short-term interest rate*, realised 40.6%, which is also a fairly reasonable posterior probability. What is more, the signs of all variables are identical to the signs in the main results. All-in-all we believe that these results are very supportive for our findings in Subsection 4.1. There is, however, more information in these results, which we will also discuss here.

First, there is a contradiction between the two variables *Herfindahl Index for Governments* and *Formation of the ruling government*. Both variables achieved a very high posterior probability, with 85.9% and 86.1%, respectively. Even though both variables describe the same state, their signs are inconsistent. The negative sign of the binary variable *Formation of the ruling government* makes little sense. An explanation for this result comes from the low number of observations of successful consolidation attempts for which at the same time a single party cabinet was in power. Of the sixteen successful consolidation attempts, only five occurred when a pure single party cabinet was in power. Consequently, the binary variable indicates eleven zeros and just five ones. In contrast, the continuous variable of the Herfindahl Index indicates that, in the majority of the sixteen successful consolidation attempts, the composition of the government was rather unified. To summarise this discussion, since in this case the Herfindahl Index is more specific than the government formation variable, we believe the former delivers more precise results than the latter.

Second, two new variables emerge amongst the best performing ones. These are the variable *Change in government fixed capital formation*, with 63.1% posterior probability, and the variable *Change in cyclically-adjusted direct taxes on business*, which achieved 58.8%. The signs of both variables are positively related to the dependent successes variable. According to the signs, an increase in government investment and an increase in direct tax on businesses are supportive of a successful budget consolidation. Why government investment tends to support sustainable budget adjustment might be explained by the long-term characteristics of investment. Government consumption is only a one-off event, which does not provide any income in the future, whereas investments should help to generate revenues over a longer time period and, hence, are likely to contribute to the sustainable improvement of the fiscal budget (Mankiw, 2007). Explaining the positive relation between higher business taxes and successful consolidation attempts is somewhat harder. The literature suggests that fiscal consolidation relying on tax increases is typically not sustainable (Alesina & Ardagna, 1998). Nonetheless, it seems that there might be a certain level of tax increase which does not hurt businesses and, hence, does not weigh on fiscal revenues. As the posterior probability of the variable that accounts for business taxes is, however, not very significant we do not comment further on this issue.

Table 17: BMA results with dependent variable from Alesina and Ardagna (2010)

1382 models were selected
Best 5 models (cumulative posterior probability = 0.0475):

	p!=0	EV	SD	mod 1	mod 2	mod 3	mod 4	mod 5
Intercept	100	-6.471	3.84	-7.43	-8.82	-6.14	-4.22	-12.54
cy_bal_pr	11.8	0.020	0.07	.	.	.	.	.
Δcy_bal_pr	4.8	-0.011	0.10	.	.	.	.	.
Δcy_rec_ex	5.1	-0.013	0.10	.	.	.	.	.
Δcy_tx_prod	9.6	-0.082	0.33	.	.	.	.	.
Δcy_tx_bus	58.8	1.207	1.33	2.34	2.25	.	2.12	.
Δcy_tx_hh	2.1	-0.008	0.11	.	.	.	.	.
Δcy_soc_con	3.6	-0.011	0.20	.	.	.	.	.
Δcy_dis_pr	4.2	0.003	0.15	.	.	.	.	.
Δcy_dis_prca	2.1	-0.004	0.05	.	.	.	.	.
Δgv_soc_ben	69.3	-1.571	1.50	-2.18	-2.24	-3.35	.	-2.20
Δgv_subs	42.1	1.386	2.19	.	.	4.44	.	2.99
Δgv_nwg_con	1.7	0.008	0.24	.	.	.	.	.
Δgv_wg_con	5.6	0.077	0.48	.	.	.	.	.
gv_gr_liab	41.5	-0.011	0.02	-0.03	.	-0.04	-0.02	.
Δgv_cp_frm	63.1	2.909	2.92	4.56	4.31	5.45	.	4.00
Δunempl	3.4	0.000	0.01	.	.	.	.	.
Δgdp_real	10	0.040	0.15	.	.	.	.	.
inflation	2.7	0.000	0.02	.	.	.	.	.
Δshort_ir	40.6	-0.207	0.30	-0.50	-0.47	-0.59	.	.
long_ir_real	3.3	0.005	0.04	.	.	.	.	.
Δnet_exp	10.1	0.044	0.18	.	.	.	.	.
Δexch_eff	8.7	0.007	0.03	.	.	.	.	.
Δprv_cons	3.6	0.027	0.21	.	.	.	.	.
Δprv_cp_frm	9.7	0.080	0.30	.	.	0.86	.	.
Δunt_lb_cst	4.7	0.003	0.03	.	.	.	.	.
pop_65over	2	0.002	0.03	.	.	.	.	.
herf_gov	85.9	8.670	5.27	12.09	11.41	12.94	7.13	10.23
corruption	10.2	0.080	0.30	.	.	.	.	1.04
gov_form	86.1	-4.137	2.47	-5.46	-5.25	-6.55	-3.40	-4.93
gov_left	2.4	0.013	0.15	.	.	.	.	.
gov_right	2.2	-0.012	0.14	.	.	.	.	.
nVar				7	6	8	4	6
BIC				-268.55	-269.13	-267.41	-270.61	-268.75
post prob				0.011	0.010	0.009	0.009	0.008

6 Conclusion

The dramatic European debt crisis and the downgrade of the USA as a debtor of highest quality are clear signs that many countries have to adjust their fiscal budgets, sooner rather than later. Unfortunately there is no panacea that can relieve highly indebted countries from their enormous burdens. Accordingly, many of the efforts to consolidate the central government's budget did not succeed in the past (Alesina, 2010). Nevertheless, there are some factors and measurements which can be supportive for governments trying to bring their debts back to sustainable levels. Determining which factors and measurements are more promising for a successful budget adjustment will not only help countries that are willing to improve their fiscal deficits, but will also provide crucial information for international organisations trying to set the right incentives at a supranational level. This thesis aimed to throw more light on these supporting factors.

The contribution of this paper to the existing literature is manifold. First and foremost, we identified three variables which are likely to be included in a generalised linear model explaining the success rate of fiscal consolidation attempts. The variables are *Change in social security benefits paid by general government*, *Change in short-term interest rate* and the *Herfindahl Index for Governments*. According to the signs of the variables, a decrease in expenditures for social benefits, an expansionary monetary policy and a unified government increase the chance for a successful fiscal consolidation. Second, our tests confirm that there is a high level of model uncertainty, with only low posterior model probabilities for even the best models. This led us to the conclusion that it makes more sense to focus on individual variables and their probability of being included in the model, than on the concrete model composition. Finally, the robustness checks confirmed our findings in many areas. In addition, the further analysis through the robustness checks brought to light some other possible success factors. Accordingly, a low long-term interest rate, a decrease in direct household taxes, a decrease in the unemployment rate, an increase in direct taxes for businesses and an increase in government investment spending enhance the chances for a successful budget adjustment.

Needless to say, however, this paper is subject to many limitations. First, the number of countries and variables included in the dataset is restricted by data availability. Under

Bayesian model averaging, for each observation all data points have to be available, therefore, several variables that might have an influence on the success of fiscal consolidation attempts had to be neglected. Besides this, other relevant variables which have not, to date, been discussed in the literature might emerge in the future. Furthermore, in order to calculate the dependent success variable, it was necessary to make many assumptions. Consequently, other definitions for the consolidation attempts and the success rate might result in different findings. We tried, however, to control for this weakness by performing several robustness checks. Last, there are some methodological constraints. Bayesian model averaging is a complex statistical method, with many parameters for which assumptions have to be made. A change in these assumptions may lead to a different outcome. Due to the limitations of this paper there is much room for further research. For example, the dataset could be enlarged by adding further variables. Alternatively, a dependent variable could be applied, which does not only account for either success, or failure, but also takes into account the magnitude of a fiscal budget improvement, or aggravation. Ultimately, further research could be performed based on another statistical methodology which, for instance, would account for endogeneity.

To summarise, we would like to combine the conclusions of this paper with some suggestions for political leaders. First, increasing social costs are one of the major challenges that will be faced by most OECD countries in coming years (Adema, Fron & Ladaique, 2011). Nonetheless, countries which already have stressed fiscal budgets are advised to focus on political solutions to reduce social spending, in order to leverage the success probability of a fiscal consolidation attempt. Second, we found that central banks can accommodate fiscal consolidation attempts by easing monetary policy. Even though the central bank is, in most cases, managed independently of the government, a slight and controlled increase in the inflation rate might be considered in order to lower the debt burden. Finally, a political consensus seems to be important for successful fiscal consolidation. Given, however, that political systems and constitutions cannot be easily changed, the introduction of fiscal rules might be a feasible solution to prevent fiscal authorities from spending too much, or being too generous to their major voters (Guichard et al., 2007).

Appendix A – Methodology for measuring cyclically adjusted budget balances

In this appendix, the method that was applied in this paper to measure cyclically-adjusted budget balances is explained. This is the OECD's cyclical adjustment method. For a detailed description of the latest update see Girouard and André (2005). Previous updates are reported by van den Noord (2000).

On the revenue side, the following four different types of taxes are separately examined when adjusting for cyclical components; personal income tax, social security contributions, corporate income tax, and indirect taxes. On the spending side, only unemployment-related transfers are responsive to differences in the economic cycle. Considering this factors, the cyclically-adjusted balance, according to Girouard and André (2005), is defined as:

$$b^* = \left[\left(\sum_{i=1}^{4} T_i^* \right) - G^* + X \right] \quad (1)$$

where:

G^* = cyclically-adjusted current primary government expenditures;

T_i^* = cyclically-adjusted component of the i^{th} category of tax; and

X = non-tax revenues minus capital and net interest spending.

The cyclically-adjusted revenue components in the above formula are calculated according to the ratio of potential output to actual output and the assumed elasticity:

$$Ti^*/Ti = (Y^*/Y)^{\varepsilon_{t_i,y}} \quad (2)$$

The cyclically-adjusted government expenditures are derived from the ratio of structural unemployment to actual unemployment and the assumed elasticity:

$$G^*/G = (U^*/U)^{\varepsilon_{g,u}} \quad (3)$$

where:

T_i = actual tax revenues for the i^{th} category of taxes;

G = actual current primary government expenditures (excluding capital and interest spending);

Y = level of actual output;

U* = level of structural unemployment;

U = level of actual unemployment;

$\varepsilon_{t_i,y}$ = elasticity of the i^th tax category with respect to the output gap; and

$\varepsilon_{g,u}$ = elasticity of current primary government expenditure with respect to the ratio of structural to actual unemployment.

By inserting Equations (2) and (3) into Equation (1) the following cyclically-adjusted balance is derived:

$$b^* = \left[\left(\sum_{i=1}^{4} T_i (Y^*/Y)^{\varepsilon_{t_i,y}} \right) - G (U^*/U)^{\varepsilon_{g.u}} + X \right] \quad (4)$$

For more detail on how the fiscal elasticities are specified and calculated please refer to Girouard and André (2005).

Appendix B – R codes used for Bayesian model averaging

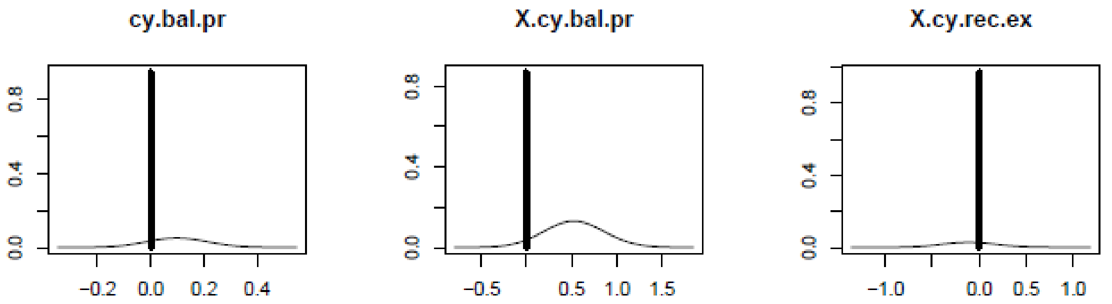
The data evaluation for Bayesian model averaging was conducted with the statistical program R. For those who want to reconstruct the results, the R-codes used in the data analysing process are included below. The dataset will be provided on request.

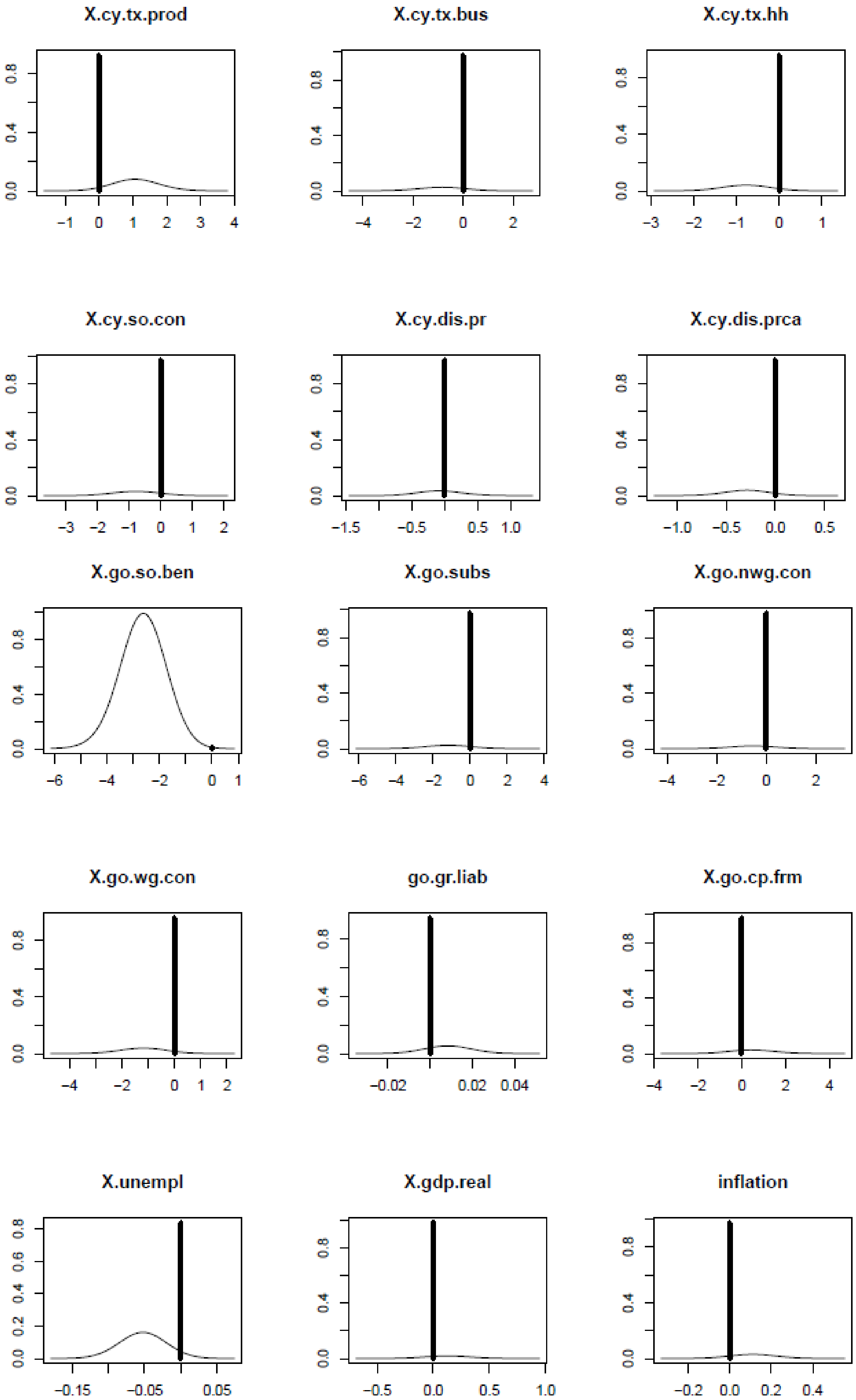
```
## upload the data set from excel
library(RODBC)
data=odbcConnectExcel (file.choose())
sqlTables (data)
Data1=sqlFetch (data, "Tabelle2")
odbcClose (data)


## definition of the objects (x and y)
library (BMA)
library (leaps)
y <- Data11$success_cyc_bal_ap1
Data2 <- data.frame(y, Data11[,-6])
Data3 <- data.frame (Data2[,-c(2:6)])
x <- data.frame (Data3[,c(2:14,17:18, 20:32, 34:36 )])


## applying the bic.glm function
ap11.out.FF <- bic.glm (x, y, strict = FALSE, OR = 10000, glm.family="binomial",
maxCol=40, factor.type=FALSE, occam.window=FALSE, factor.prior.adjusts=TRUE,
prior.param = c(rep(0.5, ncol(x))))


## receiving the output
summary (ap11.out.FF)


## plot of BMA posterior distribution of the coefficients
plot (ap11.out.FF, mfrow=c(3,3))


## plot of Models selected by BMA
imageplot.bma (ap11.out.FF, order = c("probne0"))
```

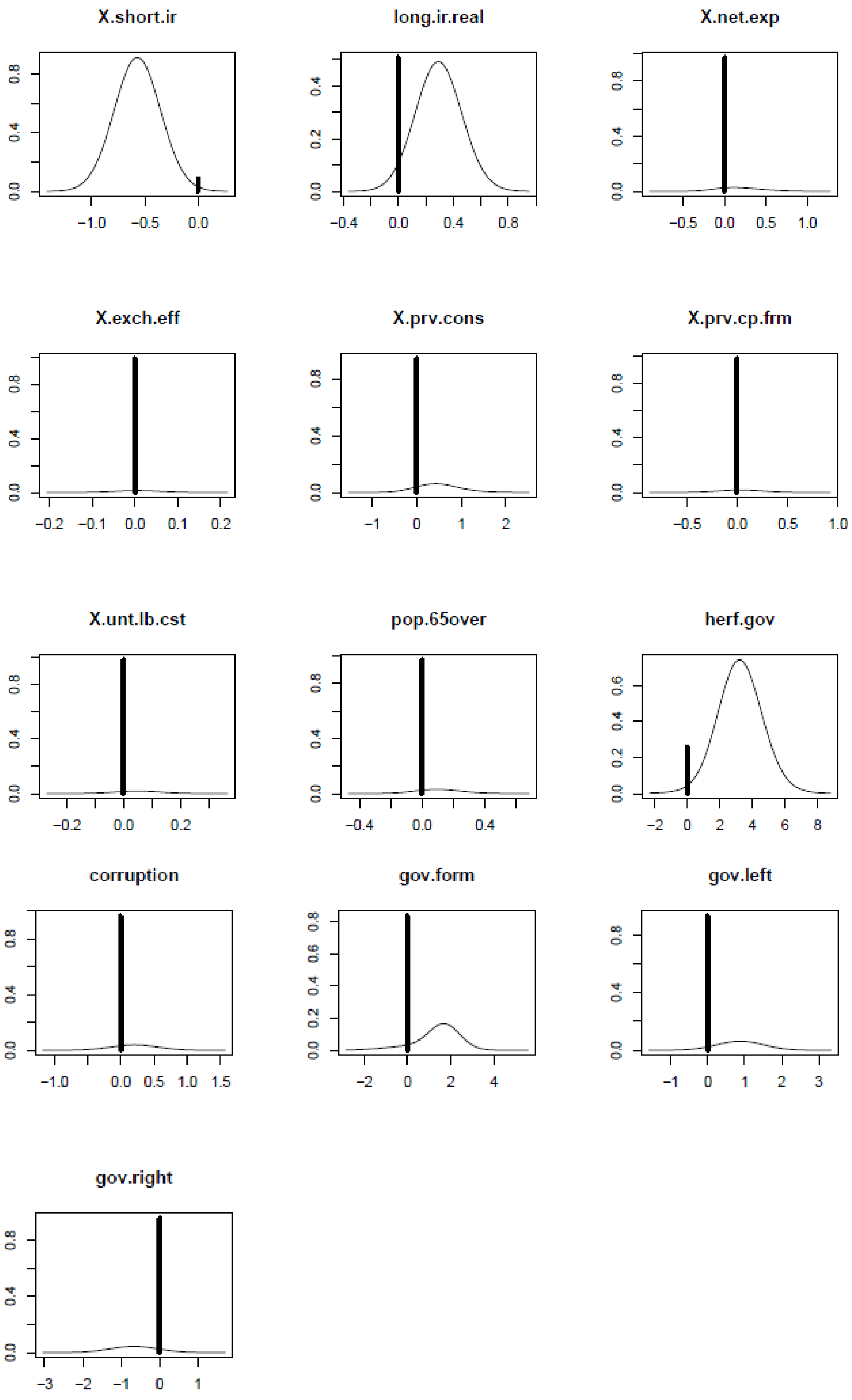
Appendix C – BMA posterior distribution of the coefficients

In Figure 2, the BMA posterior distribution for each of the coefficients of the 31 independent variables, which were regressed against the dependent variable *loose criterion*, are illustrated. The curve is the model-averaged posterior density of the coefficient, given that the variable is in the model. The density curve is an approximation of a finite mixture of normal distributions; one for each model that includes the variable (Raftery et al., 2005). The inflection point of the curve indicates the probability of the variable being in the model. In contrast, the vertical line at 0 shows the posterior probability that the variable is not in the model (this is equal to 1 minus the posterior probability of the coefficient). In our example, the variables *Change in social security benefits paid by general government* (X.go.so.ben), *Change in short-term interest rate* (X.short.ir) and *Herfindahl Index for Governments* (herf.gov) have the highest posterior probabilities for being included in the model. For instance, the pronounced peak of the curve in the plot of the variable X.go.so.ben indicates a high posterior probability (99.3%) that the variable is in the model whereas the very short vertical line stands for the low probability (100%-99.3%=0.07%) that the variable is not in the model. A completely opposite picture is, for instance, pointed out in the plot of the variable *Change in nominal effective exchange rate* (X.exch.eff). The peak of the density distribution curve is close to zero (1.4%) and the vertical spike is very high (100%-98.6%=1.4%). The explanation for this plot is the low posterior probability that the variable will be included in the model and, vice versa, a high probability that it will not be included in the model.

Figure 2: BMA posterior distribution of the coefficients



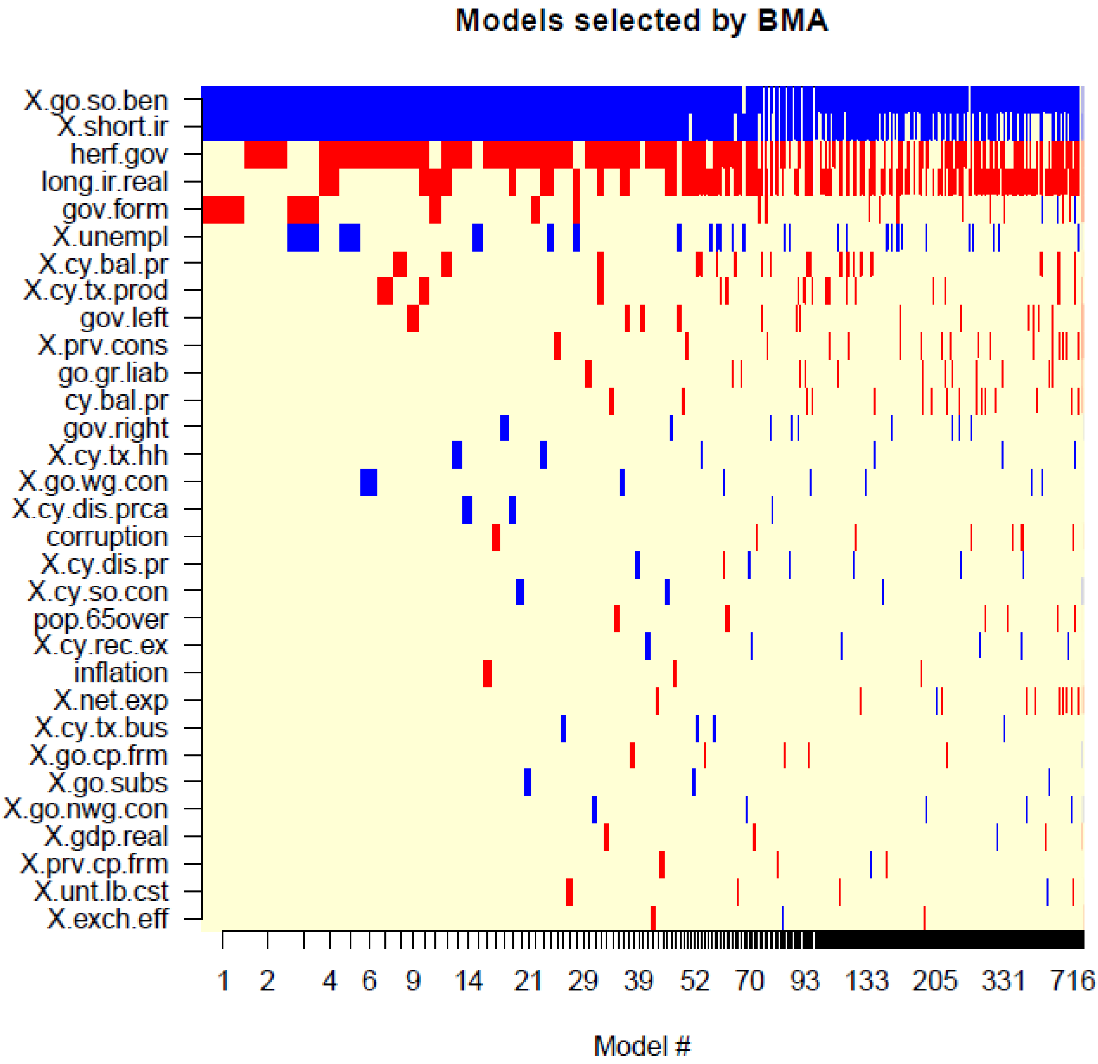

X.cy.tx.prod
0.0 0.4 0.8
−1 0 1 2 3 4
X.cy.tx.bus
0.0 0.4 0.8
−4 −2 0 2
X.cy.tx.hh
0.0 0.4 0.8
−3 −2 −1 0 1
X.cy.so.con
0.0 0.4 0.8
−3 −2 −1 0 1 2
X.cy.dis.pr
0.0 0.4 0.8
−1.5 −0.5 0.5 1.0
X.cy.dis.prca
0.0 0.4 0.8
−1.0 −0.5 0.0 0.5
X.go.so.ben
0.0 0.4 0.8
−6 −4 −2 0 1
X.go.subs
0.0 0.4 0.8
−6 −4 −2 0 2 4
X.go.nwg.con
0.0 0.4 0.8
−4 −2 0 2
X.go.wg.con
0.0 0.4 0.8
−4 −2 0 1 2
go.gr.liab
0.0 0.4 0.8
−0.02 0.02 0.04
X.go.cp.frm
0.0 0.4 0.8
−4 −2 0 2 4
X.unempl
0.0 0.2 0.4 0.6 0.8
−0.15 −0.05 0.05
X.gdp.real
0.0 0.4 0.8
−0.5 0.0 0.5 1.0
inflation
0.0 0.4 0.8
−0.2 0.0 0.2 0.4


X.short.ir
0.0 0.4 0.8
−1.0 −0.5 0.0
long.ir.real
0.0 0.2 0.4
−0.4 0.0 0.4 0.8
X.net.exp
0.0 0.4 0.8
−0.5 0.0 0.5 1.0
X.exch.eff
0.0 0.4 0.8
−0.2 −0.1 0.0 0.1 0.2
X.prv.cons
0.0 0.4 0.8
−1 0 1 2
X.prv.cp.frm
0.0 0.4 0.8
−0.5 0.0 0.5 1.0
X.unt.lb.cst
0.0 0.4 0.8
−0.2 0.0 0.2
pop.65over
0.0 0.4 0.8
−0.4 0.0 0.4
herf.gov
0.0 0.2 0.4 0.6
−2 0 2 4 6 8
corruption
0.0 0.4 0.8
−1.0 0.0 0.5 1.0 1.5
gov.form
0.0 0.2 0.4 0.6 0.8
−2 0 2 4
gov.left
0.0 0.4 0.8
−1 0 1 2 3
gov.right
0.0 0.4 0.8
−3 −2 −1 0 1

Appendix D – Models selected by BMA

Figure 3 provides a visual summary of the BMA output, calculated with the *loosely* defined independent variable (cf. Subsection 4.1). The plot is produced by the command imageplot.bma, which is part of the BMA package within the statistical software R (for further explanation of the R codes see Appendix B). Each row in Figure 3 corresponds to a variable and each column corresponds to a model. The corresponding rectangle is blue, or red, if the variable is in the model and beige otherwise. Blue indicates that the variable estimate is negative, while red indicates a positive variable estimate. For instance, the change in government social benefit payments is negatively related to the success rate of budget consolidation, whereas the Herfindahl Index is positively related to a strengthening of the fiscal budget. Furthermore, the width of the columns is proportional to the model's posterior probability. Hence, since the models are ranked by the posterior model probability, the widths of the columns decrease the further to the right we move in the plot. Also interesting to observe is that the variables *Change in social security benefits paid by general government* and *Change in short-term interest rate* are included in all of the top 50 models. On the contrary, the variable *Herfindahl Index for Governments* does not appear in some of the top models. We can also see that the real long-term interest rate exhibits quite a high density towards the right hand side of the plot, but is not represented in the bulk of the models with high posterior model probabilities.

Figure 3: Models Selected by BMA



Appendix E – Dependent variable according to Alesina and Ardagna (2010)

In Subsection 5.3, the dependent success variable was derived from a research paper by Alesina and Ardagna (2010). In this appendix the related observations for fiscal adjustment attempts and successful consolidations are listed. The definitions for the calculations of the variable can be found in Subsection 5.3. Table 18 shows all of the 104 consolidation attempts. Nonetheless, 23 observations had to be dropped due to insufficient data for the independent variables. The years that were not considered are highlighted in bold characters. This means that 81 consolidation attempts were included in the dataset.

Table 18: Consolidation attempts Alesina and Ardagna (2010)

Australia	**1987**	**1988**							
Austria	1984	1996	1997	2005					
Belgium	1982	1984	1987	2006					
Canada	1981	1986	1987	1995	1996	1997			
Denmark	1983	1984	1985	1986	2005				
Finland	**1976**	1981	1984	1988	1994	1996	1998	2000	
France	1979	1996							
Germany	1996	2000							
Greece	**1976**	**1986**	**1991**	**1994**	**1996**	**2005**	**2006**		
Ireland	**1976**	1984	1987	1988	1989	2000			
Italy	**1976**	1980	1982	1990	1991	1992	1997	2007	
Japan	1984	1999	2001	2006					
Netherlands	1983	1988	1991	1993	1996				
New Zealand	1987	1989	1993	1994	2000				
Norway	**1979**	**1980**	1983	1889	1996	2000	2004	2005	
Portugal	**1982**	**1983**	**1986**	**1988**	**1992**	**1995**	**2002**	**2006**	
Spain	1986	1987	1994	1996					
Sweden	1981	1983	1984	1986	1987	1994	1996	1997	2004
United Kingdom	**1977**	1982	1988	1996	1997	1998	2000		

Table 19 summarises all the successful consolidation attempts. All-in-all, of the 104 consolidation attempts 19 were successful. Three of the successful consolidation attempts had to be dropped due to insufficient data. These observations are, once again, indicated in bold characters. After subtracting all the observations for which we had a lack of data availability, the binary dependent variable consists of 65 zeros for the unsuccessful adjustment attempts and 16 ones for the successful consolidation attempts.

Table 19: Successful consolidation attempts Alesina and Ardagna (2010)

Austria	2005			
Denmark	2005			
Finland	1998			
Ireland	2000			
Italy	1982			
Netherlands	1993	1996		
New Zealand	1993	1994		
Norway	**1979**	**1980**	1989	1996
Sweden	1986	1987	2004	
United Kingdom	**1977**	1988	2000	

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